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INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY
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"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exculta; malè doctis et barbaris semper inimica fuit."—Linnæus.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—Bruckner, *Théorie du Système Animal*, Leyden, 1767.

. . . . The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. Taylor, *Norwich*, 1818.

ALERE FLAMMAM.

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THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

> "……………… per litora spargite muscum,
> Naiades, et circùm vitreos considite fontes:
> Pollice virgineo teneros hìc carpite flores:
> Floribus et pictum, divæ, replete canistrum.
> At vos, o Nymphæ Craterides, ite sub undas
> Ite, recurvato variata corallia trunco
> Vellite muscosis e rupibus, et mihi conchas
> Ferte, Deæ pelagi, et pingui conchylia succo."
>
> *N. Parthenii Giannettasi*, Ecl. 1.

No. 79. JULY 1934.

I.—*The* Asilidæ *of Australia.*—Part II. By G. H. Hardy, Walter and Eliza Hall Fellow in Economic Biology, Queensland University, Brisbane.

Subfamily *Dasypogoninæ.*

Section II.

This section contains all forms in which the prosternum is separated from the pronotum by a membrane; it is formed by a plate immediately adjacent to the anterior coxæ and that partly overlaps the membrane.

Tribe Saropogonini.

Hardy, Proc. Linn. Soc. N.S. Wales, li. 1926, p. 308; lii. 1927, p. 395; lv. 1930, p. 252.

The antennæ have three or four segments that invariably terminate in an apical spine. The metasternum is adjacent to the intermediate coxæ and the metanotum is bare on the Australian forms, and often with hairs on exotic ones. The abdomen contains at least seven visible segments and the female terminalia has the acanthophorites with the spines well developed. The anterior tibiæ are often provided with a spur. Several sets of veins may meet before reaching the wing-margin, but in most genera the venation is simple.

This tribe forms a complex of various units, and many of these may later be regarded as primitive genera of other tribes. The upper forceps are rarely developed, and usually the ninth tergite of the male retains its primitive nature, but is sometimes split along the median line. Many of its features parallel those of the Stichopogonini. Exotic genera like *Ancylorrhynchus*, *Cyrtopogon*, *Amphisbetetus*, *Pseudobolopogon* exhibit this best, and possibly such genera constitute a group within the tribe.

There are eight groups in Australia, those numbered 1, 3, and 7 being unique to the region. Four of these groups are probably widely distributed throughout the world, but group 4 has only recently been isolated for Australia, and I have not yet detected it elsewhere.

Probably *Saropogon* and *Selidopogon* belong to group 8, and so far I have not been able to segregate further exotic genera, other than those referred to in earlier papers and under genus *Stenopogon* below.

I have searched for evidence of affinities that might be traced in the faunas of Australia and South America, expecting the Saropogonini may yield some information of this nature, but, so far as can be judged from literature available, no such affinities exist.

Key to Groups and Genera of the Saropogonini.

1. Very bare species without thoracic bristles, but with a pair of thoracic spines placed one above each wing insertion. With tibial spur on anterior legs. Venation simple .... Group 3. *Chryseutria.*
   Without thoracic spines .... 2.
2. Posterior part of prothorax with one or two outstanding lateral bristles. Abdomen strongly conical. Tibial spur present.. [*Rachiopogon* group. 12. Group 8. *Thereutria*-
   Prothorax without such bristles .... 3.
3. Without spur on anterior tibiæ and the wings with third and fourth median veins coalescing before the wing-margin. Wings short. Upper forceps formed .. Group 2. *Bathypogon.*
   With or without a spur on the anterior tibiæ; in the latter case the fourth and median veins do not coalesce. Wings normal. Upper forceps rarely formed. 4.

4.	Abdomen short, rather strongly conical as a rule; if long it tapers strongly towards the apex and upper forceps are formed	5.
	Abdomen cylindrical or club-shaped	6.
5.	Scutellum with a fringe of ten or more bristly hairs. Hairs on thorax evenly distributed. Abdomen short or very short. Tibial spur present	Group 7. *Questopogon-Ateropogon* group. 11.
	Scutellum never exceeding eight marginal bristles. Abdomen long, with a globular hypopygium containing a large ventral plate. Tibial spur absent	Group 5. *Stenopogon.*
6.	Abdomen strongly club-formed and with only seven visible segments on male. Mesopleura with conspicuous long hairs on a pulverulent covered ground. With tibial spur	Group 4. *Austrosaropogon*, gen. nov.
	Abdomen either club-formed or cylindrical; with eight visible segments on male. Mesopleura bare or very exceptionally with a few weak hairs on a shining ground	7.
7.	Antennæ with four segments. Abdomen strongly club-formed. Face with hairs above tubercle and reaching towards antennæ. Tibial spur present	Group 1. *Erythropogon.*
	Antennæ with three or four segments, but the face is bare above tubercle in the latter case and usually so in the former, but if hairs be present it is confined to an area just above tubercle and does not extend towards the antennæ	Group 6. *Neosaropogon-Neodioctria* group. 8.
8.	Anterior tibiæ with spur	9.
	Anterior tibiæ without spur	*Neodioctria.*
9.	Antennæ short, the third segment being conical and hardly longer than the two basal segments	Gen. ——.
	Antennæ longer, the third segment being cylindrical and conspicuously longer than the two basal segments	10.
10.	Face exceedingly swollen, so that no definite tubercle is formed, the scanty moustache being confined to the oral margin. Abdomen club-formed	*Neocyrtopogon.*
	Face normal, the tubercle present, or if face is swollen then abdomen not club-formed	*Neosaropogon.*
11.	With soft hairs distributed over the whole face, which is prominent and without a tubercle or defined moustache. Small or rather small species on which the conical shape of the abdomen is not always apparent	*Aterpogon.*
	Face with a well-defined moustache and the tubercle large	*Questopogon.*
12.	Abdomen rather short, most of its segments being not or hardly as long as wide....	13.

	Abdomen very long, all its segments being much longer than wide	*Dakinomyia*, gen. nov.
13.	With numerous long hairs on mesopleura. Moustache with two or more rows of bristles	*Thereutria.*
	Only bristles present on mesopleura; at most a few hairs occur there. Moustache with only one row of bristles ...	14.
14.	Third antennal segment only about as long as the two basal ones combined. Dull brown flies	*Metalaphria.*
	Third antennal segment usually twice as long as the two basal ones combined, rarely only as long. Black, reddish or reddish-brown flies; if brown always bright in colour.....................	*Rachiopogon.*

Group 1. **Erythropogon**-group.

There is only one genus known to me that comes into this group, which may be recognized by the male having the upper lamella undivided—that is, the lamella is formed by a single plate and is presumably the primitive form.

Genus ERYTHROPOGON White.

White, Proc. Roy. Soc. Tasmania, 1913, p. 270; 1916, p. 159: Hardy, Proc. Linn. Soc. N.S. Wales, lxvi. 1921, p. 290; li. 1926, p. 308; lv. 1930, p. 254.

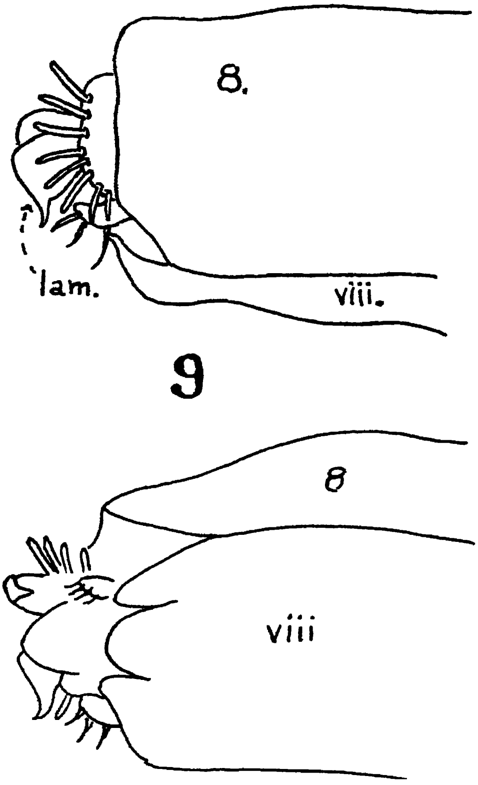
I have found the terminalia in this genus are characteristically different to the other groups of the Saropogonini, and this applies to both sexes, but I have been unable to ascertain all the characters. Two species come here, but the typical form is rare.

Erythropogon ichneumoniformis White.

Brachyrrhopala maculinevris Roder, Wien. Ent. Zeit. ii. 1883, p. 273.
Erythropogon ichneumoniformis White, Proc. Roy. Soc. Tasmania, 1913, p. 270; 1916, p. 159.
Erythropogon maculinevris Hardy, Proc. Linn. Soc. N.S. Wales, xlvi. 1921, p. 290.

Synonymy.—*Dasypogon maculinevris* Macquart, from its description, is probably a light variety of *Dasypogon australis* Macquart. Roder seems to have referred to the present species under *maculinevris* in 1883, but in 1892 he seems to have applied the name in conformity with Macquart's species. It seems advisable to utilize the name given by White for the typical species, as this certainly applies.

Hab. Tasmania, Victoria, and Queensland. White reports the species was bred by the late F. P. Spry, who later informed me he secured the larva from an old tree-stump.



Erythropogon australis Macq. Lateral and ventral views of the female terminalia. Note the supplementary bristles on the lateral appendage below spines; these occur in Therevidæ and primitive genera of Asilidæ.

Erythropogon australis Macquart. (Fig. 9.)

Dasypogon australis Macquart, Dipt. Exot. i. (2) 1838, p. 45: Walker, List Dipt. B.M. vi. suppl. 2, 1854, p. 482: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 350.

Erythropogon australis Hardy, Proc. Linn. Soc. N.S. Wales, lv. 1930, p. 254.

Dasypogon limbipennis Macquart, Dipt. Exot. suppl. 1, 1844, p. 62: Walker, List Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 479.

Brachyrrhopala limbipennis Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 487: White, Proc. Roy. Soc. Tasmania, 1916, p. 157.

Erythropogon limbipennis Hardy, Proc. Linn. Soc. N.S. Wales, li. 1926, p. 308.

Dioctria tasmanica Walker, Ins. Saund. Dipt. i. 1851, p. 85: Walker, List Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 388: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 352.

? *Dasypogon maculinevris* Macquart, Dipt. Exot. suppl. 4, 1849, p. 65: Roder, Stett. Ent. Zeit. liii. 1892, p. 224 (*maculinervis*).

Hab. Tasmania, Victoria, New South Wales, and Queensland. The species is commonly found at flowering tea-tree (*Melaluca*) in the spring.

NOTE.—The elongate ovipositor differs from the usual type found in the Saropogonini, and is not unlike that of certain Therevidæ in general appearance.

Group 2. **Bathypogon-Microstylum** group.

The terminalia of the male have the ninth tergite developed into forceps, whilst the venation is characteristic in having the fourth and fifth median veins coalescing for a long distance. There is only one genus in Australia.

Genus BATHYPOGON Loew.

Loew, Progr. Reals. Meseritz, 1851, p. 13: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 151: White, Proc. Roy. Soc. Tasmania, 1916, p. 160: Hardy, Proc. Linn. Soc. N.S. Wales, xlvi. 1921, p. 290; li. 1926, p. 311.

This is a very large genus, to which twelve names are applicable, nevertheless the species are so closely allied that they have been confused in a manner that makes them difficult to interpret. So far I have succeeded in isolating over twelve species in my own collection to which I can apply five names. In other collections there are still more species represented. Although the species are to be recognized by the form taken by the hypopygium, the colour-characters are used in the following key, as these permit the females to be relegated to their respective males.

Key to the Species of Bathypogon.

1.	Femora red and black	2.
	Femora entirely black	5.
2.	Femora entirely black at apex	3.
	Posterior or ventral side of femora (including apex) entirely red	4.
3.	Femora mostly red, but with a black stripe more or less complete on the anterior side. Upper half of moustache entirely black	*brachypterus* Macq.
	Similar, but the black stripe of the femora may be absent or incomplete and the	

moustache is never entirely black on the upper half, the black hairs being irregularly placed or absent	sp.
4. Femora entirely black on the anterior side, entirely red on the posterior side. Moustache black along the whole length of its centre	*nigrinus* Ricardo.
Red on the femora restricted to the ventral surface or to the posterior surface. Moustache entirely yellow	? *posticus* Walker.
5. Tibiæ yellow or red	*testaceovittatus* Macq.
Tibiæ black	*tristis* White.

Bathypogon brachypterus Macquart.

Dasypogon brachypterus Macquart, Dipt. Exot. i. (2) 1838, p. 45; suppl. 2, 1847, p. 34: Walker, List Dipt. B.M., vi. suppl. 2, 1854, p. 482.

Bathypogon brachypterus Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 152; (9) i. 1918, p. 58: White, Proc. Roy. Soc Tasmania, 1916, p. 161: Hardy, Proc. Linn. Soc. N.S. Wales, li. 1926, p. 311, fig. 4.

Undoubtedly the above references incorporate a complex of species, one of which I regarded as typical and published a figure of the terminalia in 1926. The species comes from Sydney, the type-locality. Macquart's record of 1847, a male from Tasmania, is evidently another species and may be the same as that described by White under the name. I believe the Queensland specimens recorded by Ricardo are the same as that unnamed species recorded in the key in the same couplet; the upper forceps are simple and this is in conformity with notes I have on specimens in the British Museum, sent by Sir Guy Marshall after comparing some figures I sent to him some years ago. White's species also occurs in Victoria, and I have specimens from both States. This makes definitely three species confused under the name.

Hab. The typical form is only known from New South Wales.

Bathypogon nigrinus Ricardo. (Fig. 10.)

Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 154: White, Proc. Roy. Soc. Tasmania, 1916, p. 162: Hardy, Proc. Linn. Soc. N.S. Wales, li. 1926, p. 311.

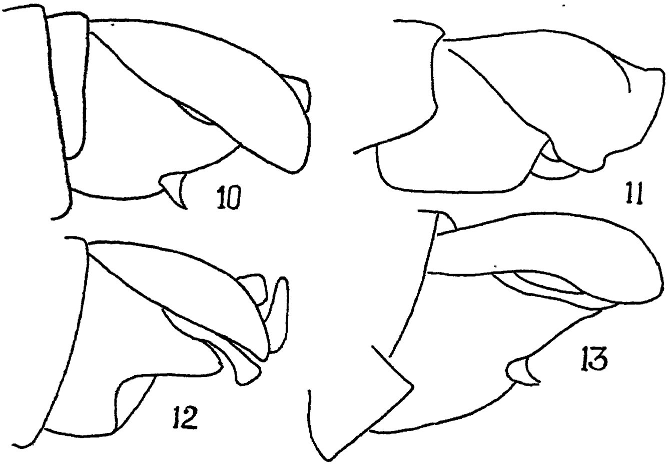
This would appear to be the most readily recognized species, and was described from Queensland. Six specimens from Ouyen (Victoria) are the largest I have seen, all being 20 mm. long.

Hab. Queensland to Tasmania; abundant in all these States.

Bathypogon posticus Walker. (Fig. 12.)

Proctacanthus posticus Walker, List Dipt. Brit. Mus. vii. suppl. 3, 1855, p. 655.

Ricardo placed this name as being probably a synonym of *brachypterus*, but the length 11 mm. and Walker's description do not conform. The type is a female from Victoria and is in bad preservation, but the description fits a Tasmanian species before me and which may ultimately prove to be identical. The drawing of the terminalia is taken from a Tasmanian specimen, one of a series (Hobart, 5 March, 1916, C. E. Cole).



Some terminalia of males in genus *Bathypogon*.

Fig. 10.—*B. nigrinus* Ricardo.
Fig. 11.—*B. testaceovittatis* Macq.
Fig. 12.—*B. posticus* Walker.
Fig. 13.—*B. tristis* White.

Bathypogon testaceovittatus Macq. (Fig. 11.)

Dasypogon testaceovittatus Macquart, Dipt. Exot. suppl. 5, 1854, p. 50.
Bathypogon testaceovittatus Bigot, Ann. Soc. Ent. France, (5) viii. 1878, p. 221: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 153; (9) i. 1918, p. 57.

There is only one specimen from Adelaide before me, but there can be no doubt concerning its identity. The terminalia may be a little distorted, but the shape of the upper forceps is sufficiently unique to identify the species even if the lower part of the drawing be erroneous.

Hab. South Australia.

Bathypogon tristis White. (Fig. 13.)

White, Proc. Roy. Soc. Tasmania, 1913, p. 272; Hardy, Proc. Linn. Soc. N.S. Wales, li. 1926, p. 312.

This species is only known to me from the holotype, the hypopygium of which is figured here.

Hab. Western Australia: Perth.

SPECIES OF *BATHYPOGON* NOT DETERMINED.

Bathypogon aoris Walker.

Dasypogon aoris Walker, List Dipt. Brit. Mus. ii. 1849, p. 321; vi. suppl. 2, 1854, p. 480.
Bathypogon aoris Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 153.

Ricardo seems to have had a complex under this name. The species was described from Adelaide, and she added Queensland to the range. The male so named from the latter State is not unlike that of *B. posticus*, according to information received. White identified two specimens from Perth as *B. aoris*, but the terminalia do not agree with those of Ricardo's species.

Hab. South Australia.

Bathypogon pedanus Walker.

Dasypogon pedanus Walker, List Dipt. Brit. Mus. ii. 1849, p. 320; vi. suppl. 2, 1854, p. 481.
Bathypogon pedanus Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 153.

From Perth and should be recognizable by its black legs with ferruginous tibiæ that are black at the apex.

Hab. Western Australia.

Bathypogon bœbius Walker.

Dasypogon bœbius Walker, List Dipt. Brit. Mus. ii. 1849, p. 333; vi. suppl. 2, 1854, p. 481.

Hab. Northern Territory: the type from Port Essington was not found by Ricardo.

Bathypogon mutilatus Walker.

Asilus mutilatus Walker, List Dipt. Brit. Mus. vii. suppl. 3, 1855, p. 739.

This was placed by Ricardo as a possible synonym of *B. aoris*.

Hab. Victoria.

Bathypogon maculipes Bigot.

Bigot, Ann. Soc. Ent. France, (5) viii. 1878, p. 433: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 154.

Hab. Australia.

Bathypogon plumbeus Fab.

Asilus plumbeus Fabricius, Syst. Ent. 1775, p. 793; Spec. Ins. ii. 1781, p. 463; Mant. Ins. ii. 1787, p. 359; Ent. Syst. 1794, iv. p. 382: Oliver, Ent. Ency. Method. iv. 1789, p. 266: Gmelin, Syst. Nat. v. 1792, p. 2898.

Dasypogon plumbeus Fabricius, Syst. Antl. 1805, p. 165; Wiedemann, Dipt. exot. 1821, p. 231; Auss. Zweifl. Ins. 1828, p. 413: Walker, List Dipt. Brit. Mus. ii. 1849, p. 333: Schiner, Verh. zool.-bot. Ges. Wien, xvi. 1866, p. 681.

Bathypogon plumbeus Loew, Prog. Reals. Meseritz, 1851, p. 14.

Not recognized from its original description, and Wiedemann did not redescribe it.

Bathypogon asiliformis Loew.

Loew, Progr. Reals. Meseritz, 1851, p. 13.

I have not seen the description of this species.

Group 3. **Chryseutria**-group.

There is only one genus known in this group, represented by a single rare species that has nearly all the main features of the tribe Chrysopogonini. The presence of the strong spines that are otherwise limited to that tribe, one above the insertion of each wing, will distinguish this group.

Genus CHRYSEUTRIA Hardy.

Hardy, Proc. Linn. Soc. N.S. Wales, liii. 1928, p. 471; lv. 1930, p. 251 (in table) and p. 252 (in key).

The antennæ have four segments and a minute spine (in the key published in 1930, the segments were erroneously given as three); moustache confined to the oral margin. Bristles present on head and prothorax, but none are developed on the mesothorax and scutellum. Abdomen with one strongly developed pair of lateral bristles on the basal segment, and all the segments are rather generalized and bulging on the dorsal surface, in which it differs from the more specialized character of the Chrysopogonini; it is longer too. Legs with a spur on the anterior tibiæ; venation simple.

Only the female is known, and the terminalia have not been dissected; nevertheless, the presence of spines there indicates the acanthophorites are well developed. There are a few scattered hairs on the mesopleura and in general the hairs and bristles are very scarce except on the legs and head, whilst on the prothorax, the eighth abdominal segment, and all sternites the hairs are quite conspicuous.

Chryseutria nigrinus Hardy.

Hardy, Proc. Linn. Soc. N.S. Wales, liii. 1928, p. 471.

Hab. Queensland. Very scarce; only known from two females.

Group 4. **Austrosaropogon**-group.

Perhaps the leading feature of this group is the resemblance the fly bears to the Brachyrrhopalini, for which it might be mistaken. It is only known to me by one species.

Genus AUSTROSAROPOGON, nov.

The antennæ have four segments and a minute spine, the third segment being cylindrical, as wide as and distinctly longer than the two basal ones. The face, with a small tubercle, contains a somewhat scanty moustache of three or four rows of bristles. The hairs on the metanotum extend on to the sternopleura, and similar hairs surround the bristles on the metapleura. On the dorsum are 1 to 3 presutural bristles, 4 to 5 supra-alar, 1 postalar, and 2 to 5 dorsocentrals each side of the median line, and one pair of scutellar bristles. The club-shaped abdomen has on the first segment, two strong lateral bristles each side, the narrower second segment has one lateral bristle, the third and fourth segments widen towards their apex and the fifth and sixth taper to the narrow seventh. The eighth segment is not detected on the male. The terminalia are conspicuous, and they resemble the form taken by *Neosaropogon*. The anterior tibiæ have an apical spur and the wing-venation is simple.

Austrosaropogon claviger, sp. n.

Saropogon sp. Hardy, Proc. Linn. Soc. N.S. Wales, lv. 1930, p. 257 (referred to as a new genus).

Male.—The black head has a golden face and a white moustache, whilst the postocular region is grey with the beard white, and the hairs on the basal part of the palpi are white too. The prothorax is black above and yellow laterally. The rest of the thorax is yellow, but with a black ground that shows as two broad admedian stripes that do not reach the scutellum, and a pair of lateral stripes that run on to the yellow scutellum. Though the abdomen may be mainly black with half the fifth and most of the sixth segments yellow or reddish, yet so wide are the variations, all grades are found with the colour showing as central spots on many or all of the segments, till, in the extreme case, the abdomen may be mostly yellow. The legs, which are mainly black, have the coxæ, the base of the femora, and the base of the tibiæ yellow, and the apex of the femora may be yellow too. The tarsi are reddish with black stains. The wings are slightly smoky with this colour deepening towards the tip. Length 8 to 16 mm.

The female is similar, but seems to be rarely taken, so that a full range of its colour-characters cannot be given.

Hab. Queensland: Brisbane, September to October, 1923 to 1929, 20 males, also others in various collections. One female before me and a few others are represented elsewhere. New South Wales: Narrabeen, 3rd December, 1921, 1 male.

Group 5. **Stenopogon**-group.

The genera that belong to this group include *Stenopogon*, which has typically seven visible segments on the male abdomen, *Scleropogon* and *Ospriocerus* both with eight, and the African genus *Goniocelis*, which I have not seen but presumably also has eight. Of the species still standing under the name *Stenopogon*, there are a number with eight visible segments, but presumably these will be excluded in time. All the forms known to me in these genera have the hairs of the face reaching from the antennæ towards the tubercle, except on *Scleriopogon helvolus* Loew. Also they are provided with a large ventral plate which seems to be one of the most important features of the hypopygium. This suggests that *Selidopogon* should also be placed in the group, for it has the same type of facial hairs and hypopygium, but the face is wider than normal; it has seven visible segments on the male. The Australian genus *Neodioctria* has many of its characters in common, but would seem to be nearer in its alliance with the *Neosaropogon* group, to which it is here referred.

Genus STENOPOGON Loew.

Stenopogon Loew, Linn. Ent. ii. 1847, p. 453: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 155: White, Proc. Roy. Soc. Tasmania, 1916, p. 162; 1917, p. 78: Hardy, Proc. Linn. Soc. N.S. Wales, xlvi. 1921, p. 291; li. 1926, p. 309; lv. 1930, p. 259: Malloch, Proc. Linn. Soc. N.S. Wales, liii. 1926, p. 607.

Neoscleropogon Malloch, Proc. Linn. Soc. N.S. Wales, liii. 1928, p. 607: Hardy, Proc. Linn. Soc. N.S. Wales, lv. 1930, p. 253 (in key).

The Australian species placed in this genus have only seven segments visible on the abdomen of the male, and they are divisible into two groups, one being limited to mountains and other high areas, like the Bogong plains, Victoria. This second group contains small rather bare species, of which four are known to me. Malloch gives the name *Neoscleropogon* for the Australian species, basing this on a very faulty diagnosis, which I tried to improve in 1930. The upper forceps are formed in this genus, which, together with the narrow face and typical moustache, and the inverted hypopygium which makes the ventral plate appear like a dorsal one, will readily distinguish this genus from all others in Australia.

Key to the described Species of Stenopogon.

1. Moustache almost entirely black; there are some silvery-white hairs easily detected below. All femora black. Male terminalia with ventral plate strongly prolonged and curved	*nicoteles* Walker.
Moustache conspicuously yellow, usually entirely so	2.
2. Ventral plate with a curved prolongation. All femora black. Face often with black hairs just at the base of the antennæ. The last two segments of the female abdomen often reddish	*fraternum* Bigot.
Ventral plate simple; without prolongation .	3.
3. Ventral plate emarginate at apex. Face with black hairs above and on each side of the otherwise yellow moustache. All femora with the apical half red, basal half black...	*emarginatus* Hardy.
Ventral plate rounded at the apex. Face always with hair entirely yellow, at most a few black ones at the base of the antennæ.	4.

4. Posterior femora, as well as the anterior and intermediate, apically red and basally black. *lanatus* Walker.
Posterior femora entirely black or rarely a little red at the extreme apex and then usually confined to the lower side......... 5.
5. Intermediate femora almost entirely red apically .... *flavipennis* White.
Intermediate femora mainly or entirely black. 6.
6. Anterior and intermediate femora at the extreme apex red, the colour being separated by a very definite line .... *digentia* Walker.
Anterior and intermediate femora entirely black................................ *agave* Walker.

Stenopogon nicoteles Walker.

Dasypogon nicoteles Walker, List Dipt. Brit. Mus. ii. 1849, p. 320; vi. suppl. 2, 1854, p. 481.
Stenopogon nicoteles Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 157: Hardy, Proc. Roy. Soc. Queensland, xxxix. 1928, p. 120.

Hab. Western Australia.

Stenopogon fraternum Bigot.

Dasypogon elongatus var. (first) Macquart, Dipt. Exot. suppl. 2, 1847, p. 34.
Stenopogon elongatus var. White, Proc. Roy. Soc. Tasmania, 1916, p. 164.
Stenopogon elongatus Hardy, Proc. Linn. Soc. N.S. Wales, li. 1926, p. 309.
Stenopogon fraternum Bigot, Ann. Ent. Soc. France, (5) viii. 1878, p. 421: Hardy, Proc. Roy. Soc. Queensland, xxxix. 1928, p. 121.

Hab. Tasmania, New South Wales.

Stenopogon emarginatus Hardy.

Hardy, Proc. Roy. Soc. Queensland, xxxix. 1928, p. 121.

Hab. Victoria.

Stenopogon lanatus Walker.

Dasypogon elongatus var. (second) Macquart, Dipt. Exot. suppl. 2, 1847, p. 34.
Stenopogon elongatus White, Proc. Roy. Soc. Tasmania, 1916, p. 163 (typical form only).
Dasypogon lanatus Walker, List Dipt. Brit. Mus. ii. 1849, p. 318; vi. suppl. 2, 1854, p. 480.
Stenopogon lanatus Hardy, Proc. Roy. Soc. Queensland, xxxix. 1928, p. 121.

Hab. Tasmania, South Australia, Western Australia.

Stenopogon flavipennis White.

Dasypogon elongatus Macquart, Dipt. Exot. suppl. 1, 1844, p. 66: Walker, List Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 482.
Stenopogon elongatus Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 155 (part only), name preoccupied.

Stenopogon flavipennis White, Proc. Roy. Soc. Tasmania, 1917, p. 79 : Hardy, Proc. Roy. Soc. Queensland, xxxix. 1928, p. 121.

Hab. New South Wales.

Stenopogon thalpius Walker.

Dasypogon thalpius Walker, List Dipt. Brit. Mus. ii. 1849, p. 317 ; vi. suppl. 2, 1854, p. 481.
Stenopogon thalpius Hardy, Proc. Roy. Soc. Queensland, xxxix. 1928, p. 122.

Hab. Western Australia.

Stenopogon digentia Walker.

Dasypogon digentia Walker, List Dipt. Brit. Mus. ii. 1849, p. 316 ; vi. suppl. 2, 1854, p. 480.
Dasypogon flavifacies Macquart, Dipt. Exot. suppl. 4, 1849, p. 64.
Stenopogon digentia Hardy, Proc. Roy. Soc. Queensland, xxxix. 1928, p. 122.

Hab. Queensland.

Stenopogon agave Walker.

Dasypogon agave Walker, List Dipt. Brit. Mus. ii. 1849, p. 317 ; vi. suppl. 2, 1854, p. 480.
Stenopogon agave Hardy, Proc. Roy. Soc. Queensland, xxxix. 1928, p. 122.

Hab. Western Australia : Queensland, New South Wales, South Australia.

Group 6. **Neosaropogon-Neodioctria** group.

This group is represented by many species, the majority remain undescribed, and those known fall into genus *Neosaropogon*, which is probably a complex. The other two genera are recognizable only in one known species each. Although a homogeneous group in the main, there are no outstanding features by which it is to be recognized, except of a negative nature. It misses all or the majority of the characters that will distinguish the other groups.

Genus NEOCYRTOPOGON Ricardo.

Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 589 : Hardy, Proc. Linn. Soc. N.S. Wales, xlvi. 1921, p. 291 ; lii. 1927, p. 397 ; lv. 1930, p. 258.

Only to be distinguished from *Neosaropogon* by the swollen face combined with the club-shaped abdomen, and perhaps it is hardly worthy of separation from it.

Neocyrtopogon maculata Roder.

Brachyrrhopala maculata Roder, Wien. Ent. Zeit. ii. 1883, p. 274; Stett. Ent. Zeit. liii. 1892, p. 242: Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 587: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 60.

Neocyrtopogon maculata Hardy, Proc. Linn. Soc. N.S. Wales, lv. 1930, p. 258.

Neocyrtopogon bifasciata Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 589.

Hab. Queensland.

Genus NEOSAROPOGON Ricardo.

Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 591: Hardy, Proc. Linn. Soc. N.S. Wales, xlvi. 1921, p. 291; li. 1926, p. 308; lii. 1927, p. 397; liii. 1928, p. 472; lv. 1930, p. 258: Malloch, Proc. Linn. Soc. N.S. Wales, liii. 1928, p. 300.

Only four of the described species seem to conform to this genus, which is probably a complex, and the one here added is so very different to the others that there can be no confusing it. It is not proposed to review the described forms here, as the genus needs to be revised as a whole.

Neosaropogon princeps Macquart.

Dasypogon princeps Macquart, Dipt. Exot. suppl. 3, 1848, p. 19: Walker, List Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 479: Williston, Trans. Amer. Ent. Soc. Philadelphia, xviii. 1891, p. 76.

Laparus princeps v. d. Wulp, Tijd. v. Ent. xix. 1876, p. 172.

Plesiomma princeps Bigot, Ann. Ent. Soc. France, (5) viii. p. 222.

Saropogon princeps Frogatt, Austra. Ins. 1907, p. 300.

Neolaparus princeps Kertesz, Cat. Dipt. 1909, p. 121.

Neosaropogon princeps Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 591: Hardy, Proc. Linn. Soc. N.S. Wales, liii. 1928, p. 472; lv. 1930, p. 258.

Dasypogon allia Walker, List Dipt. Brit. Mus. ii. 1849, p. 334; vi. suppl. 2, 1854, p. 487.

? *Isopogon allia* Kertesz, Cat. Dipt. 1909, p. 63.

Dasypogon carus Walker, List Dipt. Brit. Mus. ii. 1849, p. 334; vi. suppl. 2, 1854, p. 487.

? *Isopogon carus* Kertesz, Cat. Dipt. 1909, p. 63.

Dasypogon numicius Walker, List Dipt. Brit. Mus. ii. 1849, p. 335; vi. suppl. 2, 1854, p. 487.

Isopogon numicius Kertesz, Cat. Dipt. 1909, p. 63.

Specimens that stand under this name in collections may belong to a complex.

Hab. New South Wales, Queensland.

Neosaropogon nitidus Macquart.

Dasypogon nitidus Macquart, Dipt. Exot. suppl. 1, 1844, p. 61: Walker, List Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 479.

Brachyrrhopala nitidus Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 585: White, Proc. Roy. Soc. Tasmania, 1916, p. 156: Hardy, Proc. Roy. Soc. Tasmania, 1916, p. 271.

Brachyrrhopala nitidus var. *dissimilis* Hardy, Proc. Roy. Soc. Tasmania, 1916, p. 271.
Neosaropogon nitidus Hardy, Proc. Linn. Soc. N.S. Wales, lii. 1927, p. 397; 1930, p. 258.

The variety *dissimilis* is built on a stouter plan than the typical form and resembles *N. princeps*; the others are slender.

Hab. Tasmania: apparently restricted to the Island.

Neosaropogon sergius Walker.

Dasypogon sergius Walker, List Dipt. Brit. Mus. ii. 1849, p. 347; vi. suppl. 2, 1854, p. 477.
Saropogon sergius Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 144.
Neosaropogon sergius Hardy, Proc. Linn. Soc. N.S. Wales, li. 1926, p. 309.
Dasypogon festinans Walker, Ins. Saund. Dipt. i. 1851, p. 92; List Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 485.

Hab. New South Wales.

Neosaropogon garamas Walker.

Dasypogon garamas Walker, List Dipt. Brit. Mus. ii. 1849, p. 346; vi. suppl. 2, 1854, p. 486.
Lasiopogon gamaras Kertesz, Cat. Dipt. iv. 1909, p. 73.
Saropogon gamaras Hardy, Proc. Linn. Soc. N.S. Wales, lv. 1930, p. 257 (*gamarus* in error).
Dasypogon suavis Walker, Trans. Ent. Soc. London, n.s. iv. 1857, p. 127.
Saropogon suavis Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 146.
Neosaropogon suavis Hardy, Proc. Linn. Soc. N.S. Wales, li. 1927, p. 397.

There seems to have been a confusion in the "*r*" and the "*m*" in the specific name, Kertesz having transposed these.

Hab. New South Wales.

Neosaropogon minor, sp. n.

A small shining black species, on which the face is unusually flat and with a few soft hairs above the scanty moustache.

The face, the postocular region, the prothorax, two lateral stripes of the dorsum, and the pleura and coxæ are covered with a pulverulent grey. All hairs and bristles are white. One presutural bristle, one postalar, and about six dorsocentrals are to be seen each side of the median line. A pair of weak apical scutellars, and on each side of these two further but hair-like bristles may be traced. The knees are yellowish brown, and the underside of the apical half of the posterior tibiæ and all the tarsi may be thickly covered with a similarly coloured pile.

Length 10–11 mm.

Hab. Victoria: Ouyen, January 1931, 2 males and 6 females.

NOTE.—In the key, I have indicated a possible new genus that might be divided from the mass of material that falls into genus *Neosaropogon*. In the present case there is another instance of a possible cleft from the main mass of that material. Congeneric with this species, and from the same locality, I have a male of yet another form that differs by having its face like that of *Neocyrtopogon*. It may prove possible to subdivide the genus by taking into account the presence or absence of the weak bristles on the scutellum, bringing into association with the present species *N. garamus*, possibly *N. semirufum* Bigot, and quite a number of forms yet undescribed. All these would seem to have soft hairs present above the moustache, a character that is mainly missing in the typical forms. However, this cannot be done with convenience, as *N. nitidus* would fall into the same group as *N. minor*, for it has both facial hairs and scutellar bristles. Obviously such an alliance would be incongruous, for *N. nitidus* is closely associated with the more typical forms.

There is no species capable of being confused with the present one, except an undescribed form referred to above, and which has its swollen face almost entirely covered with a pulverulent grey, and also its abdomen, and it has brownish legs.

Neosaropogon semirufum Bigot.

Saropogon semirufum Bigot, Ann. Ent. Soc. France, (5) viii. 1878, p. 414: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 147: Hardy, Proc. Linn. Soc. N.S. Wales, lv. 1930, p. 257.

The relationship of this species is not very clear; it either falls into the key where the generic name is left blank, or else into genus *Neosaropogon* associated with *N. minor*. One specimen in bad condition, and presumably this species, is all I have seen of it.

Hab. New South Wales.

? *Neosaropogon analis* Macquart.

Dasypogon analis Macquart, Dipt. Exot. suppl. 4, 1849, p. 65.

From the description given by Macquart, it seems quite possible that the species belongs to *Neosaropogon*, but I have not seen a species that conforms to all its characters.

Hab. ? New South Wales. Macquart gives Tasmania, but that is probably erroneous.

Genus NEODIOCTRIA Ricardo.

Ricardo, Ann. & Mag. Nat. Hist. (9) i. 1918, p. 58: Hardy, Proc. Linn. Soc. N.S. Wales, xlvi. 1921, p. 291; 1930, p. 259.

This genus is somewhat confusing, for not only has it the general appearance of *Neosaropogon*, but in hypopygium it approaches best to the genus *Stenopogon*, to which it could hardly be related.

Neodioctria australis Ricardo.

Ricardo, Ann. & Mag. Nat. Hist. (9) i. 1918, p. 59.

Hab. New South Wales.

Group 7. **Questopogon-Aterpogon**-group.

This is probably only a small group, for it is sparsely represented in collections and only two genera are yet placed under it. It has a short, usually strongly conical abdomen, but misses the lateral bristles of the prothorax, which distinguishes it from the *Thereutria-Rachiopogon*-group, which has a similar abdomen. On the male of *Aterpogon* I can find only six segments, which may be another distinguishing character; I have only seen females of *Questopogon*.

Genus ATERPOGON Hardy.

Hardy, Proc. Linn. Soc. N.S. Wales, lv. 1930, p. 254.

Aterpogon cyrtopogonoides Hardy.

Hardy, Proc. Linn. Soc. N.S. Wales, lv. 1930, p. 254.

Hab. Queensland: Victoria.

? *Aterpogon bella* White.

Brachyrrhopala bella White, Proc. Roy. Soc. Tasmania, 1917, p. 74.
? *Saropogon bella* Hardy, Proc. Linn. Soc. N.S. Wales, li. 1926, p. 309.
? *Aterpogon bella* Hardy, Proc. Linn. Soc. N.S. Wales, lv. 1930, p. 254.

Hab. Victoria.

Genus QUESTOPOGON Dakin & Fordham.

Dakin & Fordham, Ann. & Mag. Nat. Hist. (9) x. 1922, p. 525: Hardy, Proc. Linn. Soc. N.S. Wales, li. 1926, p. 308; lv. 1930, p. 255.

Questopogon clarkii Dakin & Fordham.

Dakin & Fordham, Ann. & Mag. Nat. Hist. (9) x. 1922, p. 525.

Hab. Western Australia.

Group 8. **Thereutria-Rachiopogon-group.**

This group forms a very large element in Australia, and is readily recognized by one or more outstanding bristles being situated on each side of the posterior part of the prothorax. It would seem also that the ninth tergite of the male is invariably divided, being either split along the median line as readily seen in *Metalaphria* or more widely divided as in certain other genera. Nevertheless, this division has not, or does not seem to have, developed far enough to be regarded as forceps. There is so much gradation from one genus to another that it is not possible to give a reliable key to those proposed, but the forms before me seem to divide themselves into the following convenient sections:—

1.	Moustache bushy or at least composed of more than one row of bristles. Black species....	*Thereutria.*
	Moustache composed of only one row of bristles	2.
2.	Abdomen short, normal in length...........	3.
	Abdomen very long, three segments extending beyond the wing-tip. Bright-coloured or partly so	*Dakinomyia*, nov.
3.	Dull brown flies	*Metalaphria.*
	Black, reddish, or reddish-brown flies; if brown always bright in colour	*Rachiopogon.*

Thereutria invariably has the two upper radial veins coalescing before the apex, and *Dakinomyia* invariably has them separated; in the other genera the character is a specific one, both forms occurring respectively in species that are indisputably congeneric.

Genus THEREUTRIA Loew.

Thereutria Loew, Prog. Realschule Mesaritz. 1851, p. 20: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 353: White, Proc. Roy. Soc. Tasmania, 1917, p. 80: Hardy, Proc. Linn. Soc. N.S. Wales, lii. 1927, p. 396: Malloch, Proc. Linn. Soc. N.S. Wales, liii. 1928, p. 608.

Scandon Walker, Ins. Saund. Dipt. i. 1851, p. 108; List Dipt. Brit. Mus. vii. suppl. 3, 1855, p. 563.

In 1920 (Zool. Jahr. Syst. xliii. p. 165) Hermann removed this genus from the Laphriinæ into his Acanthocneminæ, but its exact position was not fixed by him. It was similarly removed by me in 1927 and again by Malloch in 1928. Its ally, *Metalaphria*, shares the same fate, but the two, together with *Rachiopogon* need an adequate revision, for there are no definite lines that will mark their distinction; undescribed species show gradations from one form to another and presumably future research will be showing the need for quite a number of new genera. The moustache, however, is a character that allies the three species recorded here under this genus; there are no others known to me having this feature.

Malloch claims to have a pair mounted *in copulâ*, and according to his description of them these must be two and not one species. Collections in Australia have similarly allied sexes, for errors of this nature are made through faulty observation. Where two species occur together they will frequently attempt to intermate, and so Malloch's remarks based on this error do not interpret the facts. The behaviour of a pair about to copulate is very interesting. The male will fly and hover at the rear of any insect that will remain more or less stationary, and if a female *Thereutria* be met with the male will hover in this manner following the female about for a considerable time before darting upon her. If the male selects inadvertently another male, the two will face each other and hover; at intervals each will attempt to get to the rear of the other, which by-play will proceed for a time and then the pair will part.

1.	Legs black and red or yellow, the femora always being bicoloured. Moustache with four or more rows of bristles	2.
	Legs black and white or pale yellow, the femora are always black. Moustache with only two or three rows of bristles	*pulchra* Schiner.
2.	Femora and tibiæ about half black and half yellow	*pulchripes* White.
	Femora and tibiæ mainly red, being black only at the apex and slightly so at the base	*amaricus* Walker.

Thereutria amaricus Walker.

Laphria amaricus Walker, List Dipt. Brit. Mus. ii. 1849, p. 380; vii. suppl. 3, 1855, p. 559.
Thereutria amaricus Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 354: Hardy, Proc. Linn. Soc. N.S. Wales, lii. 1927, p. 396.
Ommatius ialmus Walker, List Dipt. Brit. Mus. ii. 1849, p. 479; vii. suppl. 3, 1855, p. 759.
Dasypogon diversicolor Macquart, Dipt. Exot. suppl. 4, 1849, p. 64: Bigot, Ann. Soc. Ent. France, (5) viii. 1878, p. 219.
Dasypogon aurifacies Macquart, Dipt. Exot. suppl. 4, 1849, p. 63.
Thereutria calcar Loew, Prog. Reals. Meseritz. 1851, p. 20: Schiner, Reise Novara Dipt. p. 169.
Scandon compacta Walker, Ins. Saund. Dipt. i. 1851, p. 108; List Dipt. Brit. Mus. vii. suppl. 3, 1855, p. 563.
Laphria diversipes Macquart, Dipt. Exot. suppl. 5, 1854, p. 53: Froggatt, Austr. Ins. 1907, p. 299.
Thereutria caligula Bigot, Ann. Soc. Ent. France, (5) viii. 1878, p. 233.
Dasypogon diversipes Kirby, Ann. & Mag. Nat. Hist. (5) xiii. 1884, p. 458.

Hab. New South Wales: Queensland.

Thereutria pulchripes White.

White, Proc. Roy. Soc. Tasmania, 1917, p. 80: Hardy, Proc. Linn. Soc. N.S. Wales, lii. 1927, p. 396.

Hab. New South Wales: Victoria.

Thereutria pulchra Schiner.

Schiner, Reise Novara Dipt. 1868, p. 169: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 355: Hardy, Proc. Linn. Soc. N.S. Wales, lii. 1927, p. 396.

Hab. New South Wales: Queensland.

Genus METALAPHRIA Ricardo.

Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 356: ? White, Proc. Roy. Soc. Tasmania, 1917, p. 81: Hardy, Proc. Linn. Soc. N.S. Wales, lii. 1927, p. 396; lv. 1930, p. 255: ? Malloch, Proc. Linn. Soc. N.S. Wales, liii. 1928, p. 608.

Neither White nor Malloch understood the position of this genus. Ricardo based it on a small form unknown to those authors, who evidently confused it with *Rachiopogon* in the sense used here. I have six or more species before me that are more or less congeneric with that of Ricardo, and one may be even conspecific.

Metalaphria australis Ricardo.

Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 356: Hardy, Proc. Linn. Soc. N.S. Wales, lii. 1927, p. 396; lv. 1930, p. 255.

Hab. Queensland.

Metalaphria tessellata Hardy.

Hardy, Proc. Linn. Soc. N.S. Wales, lv. 1930, p. 255.

Hab. Queensland.

Metalaphria dissimulans White.

Saropogon dissimulans White, Proc. Roy. Soc. Tasmania, 1917, p. 75: Hardy, Proc. Linn. Soc. N.S. Wales, liv. 1929, p. 359.

This species is evidently allied to *M. tessellata*, and I have specimens from Ouyen (Victoria), which I suspect are identical; they have the eyes wider apart than the former species, but in other respects are identical in appearance.

Genus RACHIOPOGON Ricardo.

Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 590: Hardy, Proc. Linn. Soc. N.S. Wales, li. 1926, p. 308; 1930, p. 256.

A mass of heterogeneous species is grouped under this generic name, awaiting a proper revision. Of the typical form there is only one known of its kind, but its characters are joined so intimately with the *Thereutria* and *Metalaphria* sections that I have failed to find satisfactory distinguishing characters. Even the antennal character previously used can no longer be maintained, judging from eight species before me and others seen in various collections.

Rachiopogon grantii Newman.

Dasypogon grantii Newman, Trans. Ent. Soc. Lond. iv. 1857, p. 57.
Rachiopogon grantii Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 590.

Hab. Queensland.

Rachiopogon carbo Walker.

Dasypogon carbo Walker, Ins. Saund. Dipt. i. 1851, p. 87; List Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 478: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 350.
Rachiopogon carbo Hardy, Proc. Linn. Soc. N.S. Wales, li. 1926, p. 308; iv. 1930, p. 256.
? *Dasypogon limbinevris* Macquart, Dipt. Exot. suppl. 5, 1854, p. 51.
Saropogon limbinevris Bigot, Ann. Soc. Ent. France, (5) viii. 1878, p. 222: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 146.

Hab. Victoria, South Australia.

Rachiopogon nigrinus Ricardo.

Neosaropogon nigrinus Ricardo, Ann. & Mag. Nat. Hist. (9) i. 1918, p. 60.
Rachiopogon nigrinus Hardy, Proc. Linn. Soc. N.S. Wales, li. 1926, p. 308; lv. 1930, p. 256.

Hab. Queensland.

Rachiopogon rubescens White.

Saropogon rubescens White, Proc. Roy. Soc. Tasmania. 1913, p. 271: Hardy, Proc. Linn. Soc. N.S. Wales, lii. 1927, p. 397.
Rachiopogon rubescens Hardy, Proc. Linn. Soc. N.S. Wales, lv. 1930, p. 256.

Hab. Western Australia.

Rachiopogon aurifacies White.

Metalaphria aurifacies White, Proc. Roy. Soc. Tasmania, 1917, p. 81: Hardy, Proc. Linn. Soc. N.S. Wales, lii. 1927, p. 396; lv. 1930, p. 255.

White placed this species in *Metalaphria* without knowing the type of that genus, and those forms now associated with that type do not conform very well with the present species; it seems advisable to remove it to *Rachiopogon*.

Hab. New South Wales.

SPECIES NOT IDENTIFIED.

It would appear that the following species also come within this genus *Rachiopogon*, as now understood:—

Dasypogon luctuosus Macquart, Dipt. Exot. i. (2) 1838, p. 39: Walker, List Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 488. *Thereutria luctuosus* Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 354. *Rachiopogon luctuosus* Hardy, Proc. Linn. Soc. N.S. Wales, lv. 1930, p. 256.

Dasypogon albonotatus Macquart, Dipt. Exot. suppl. 2, 1847, p. 33: Walker, List Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 479: Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 350 (said to be from Tasmania, but this is very doubtful).

Dasypogon salinator Walker, List Dipt. Brit. Mus. ii. 1849, p. 325; vi. suppl. 2, 1845, p. 477. *Neosaropogon salinator* Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 592: Hardy, Proc. Linn. Soc. N.S. Wales, li. 1926, p. 309; lii. 1927, p. 397; lv. 1930, p. 257 (in collections two species stand under this name).

Dasypogon nigripennis Macquart, Dipt. Exot. suppl. 3, 1848, p. 20: Walker, List Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 478: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 351.

Genus DAKINOMYIA, nov.

Gen. —— (part of *Neosaropogon* Ricardo) Hardy, Proc. Linn. Soc. N.S. Wales, lii. 1927, p. 397; lv. 1930, p. 256.

Antennæ with three segments and a minute spine. Each side of the median line occur 3 notopleural bristles, 2 supra-alars, 3 postalars, 4 to 5 postsutural dorsocentrals; and there is one pair of scutellar bristles. The abdomen tapers towards the apex, but is very long, the second and subsequent segments being conspicuously longer than wide. The last three segments extend well beyond the apex of the wings when at rest.

Type: *Neosaropogon froggatti* Dakin & Fordham.

Dakinomyia froggattii Dakin & Fordham.

Neosaropogon froggattii Dakin & Fordham, Ann. & Mag. Nat. Hist. (9) x. 1922, p. 523: Hardy, Proc. Linn. Soc. N.S. Wales, lii. 1927, p. 397; lv. 1930, p. 256.

Hab. Western Australia.

Dakinomyia claripennis Ricardo.

Neosaropogon claripennis Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 593: Hardy, Proc. Linn. Soc. N.S. Wales, lii. 1927, p. 397; lv. 1930, p. 256.

Hab. Queensland.

Tribe PHELLINI Hardy.

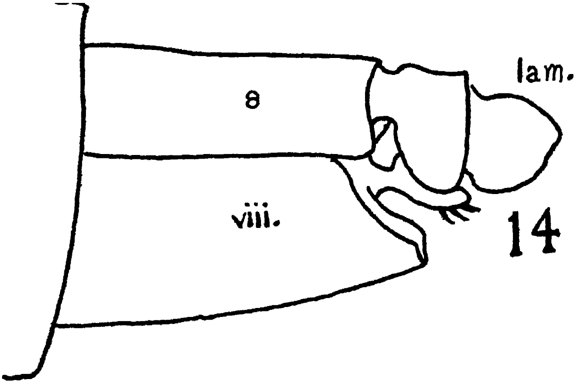
Hardy, Proc. Linn. Soc. N.S. Wales, li. 1926, p. 309; lii. 1927, p. 394; 1929, p. 354 (in key).

Although this tribe does not contain the usual form of acanthophorites, there is a sclerite in one piece (ninth tergite) that seems to represent that organ on the female. This sclerite is bristly, but bears no spines as usually associated with the well-formed acanthophorites. On the male the upper forceps are developed, which seems to suggest the tribe is well advanced and not a primitive one, and hence that extra bristly sclerite may be of special utility. The membrane separating the prosternum is definitely present, but when the insect dies it seems to harden to the constituency of the chitin—on *Phellus*, at least. I have not been able to ally this tribe with any genus of the Saropogonini, but there are features about it that seem to show possible alliance with Stichopogonini-Laphriini section, and hence it may be of rather lowly origin near that stem.

Genus Phellus Walker. (Fig. 14.)

Walker, Ins. Saund. Dipt. i. 1851, p. 110; List. Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 502: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 148: Hardy, Proc. Linn. Soc. N.S. Wales, clvi. 1921, p. 288; li. 1926, p. 309.

Only once have I met with this genus in the field (Ouyen, 1931), but in collections at least five species are represented, the specimens being mainly in rather poor condition.



Phellus Walker. Lateral aspect of the female terminalia exserted to show the ninth tergite which is entire and the lateral appendage bearing supplementary bristles, although spines of the acanthophorites are absent. Compare with fig. 9.

Phellus glaucus Walker.

Walker, Ins. Saund. Dipt. i. 1851, p. 110; List Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 503: Froggatt, Austr. Ins. 1907, p. 300: Ricardo, Ann. & Mag. Nat. Hist. (8) 1912, p. 148: Hardy, Proc. Linn. Soc. N.S. Wales, li. 1926, p. 310.

Hab. Described from Western Australia, but apparently distributed over a wide area, including Victoria, New South Wales, and Queensland.

Phellus pilifera Dakin & Fordham.

Dakin & Fordham, Ann. & Mag. Nat. Hist. (9) x. 1922, p. 521: Hardy, Proc. Linn. Soc. N.S. Wales, li. 1926, p. 310.

Hab. Described from Western Australia, but probably very widely distributed.

Genus PSILOZONA Ricardo.

Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 157: Hardy, Proc. Linn. Soc. N.S. Wales, xlvi. 1921, p. 289; li. 1926, p. 310.

Psilozona albitarsis Ricardo.

Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 157.

Hab. Queensland.

Psilozona nigritarsis Ricardo.

Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 159.

Hab. Queensland.

Tribe CHRYSOPOGONINI, new.

Three genera, hitherto incorporated under the tribe Brachyrrhopalini, are separated as they do not bear any close affinity with it, but with genus *Chryseutria* in the Saropogonini. It is to be distinguished from other tribes by the absence of practically all the thoracic bristles and of the acanthophorites, and in the presence of a pair of short stout spines, inserted one each just above the wing-insertions. The terminalia have not been dissected, and the only definite character observable is the ninth tergite, which is entire on the male and not divided or formed into forceps.

Key to the Genera of the Chrysopogonini.

1.	Anterior tibiæ with an apical spur	2.
	Anterior tibiæ without an apical spur ...	*Codula.*
2.	Antennæ with three segments and a strong terminal spine, which is conical in shape	*Opseostlengis.*
	Antennæ with three segments and a minute terminal spine	*Chrysopogon.*

Genus Chrysopogon Roder.

Roder, Berl. Ent. Zeit. xxv. 1881, p. 213; Stett. Ent. Zeit. 1892, p. 243: Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 481: White, Proc. Roy. Soc. Tasmania, 1917, p. 72: Hardy, Proc. Linn. Soc. N.S. Wales, xlvi. 1921, p. 288: Malloch, Proc. Linn. Soc. N.S. Wales, liii. 1928, p. 300: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 65.

Key to the Species of Chrysopogon.

1. Wings with the first median and fifth radial veins coalescing near wing-margin. Very large black and yellow species ... 2.
   Wings with the first median and fifth radial veins not coalescing. Abdomen widening from the base to the apex of fourth segment. Usually medium and small species .... 4.
2. Abdomen narrowing from base to apex of second segment, more or less widening from thence .... *mulleri* Roder.
   Abdomen narrowing from base to apex of third segment .... 3.
3. Abdomen with segments 3 and 4 entirely black............................ *crabroniformis* Roder.
   Abdomen with the third segment only partly marked with black, the fourth without black or mostly so above .... *splendidissimus* [Ricardo.
4. Moustache bushy along the oral margin. Abdomen with the first segment, base of second, the third, and the base of fourth black; elsewhere yellow ...... *albipunctatus* [Macquart.
   Moustache confined to one row of hairs . 5.
5. Large black species with the third to fifth segments entirely bright yellow above . *horni*, sp. n.
   Smaller species not so marked .... 6.
6. Abdomen banded with gold or with yellow and gold at the apex .... 7.
   Abdomen never with gold, if banded then usually with brown .... 8.
7. Abdomen banded with gold at the apex of the first to fifth segments, the base of sixth also golden .... *fasciatus* Ricardo.
   Abdomen banded with yellow at the apex of second to fifth segments, the whole of the sixth golden .... *conopsoides* Fab.
8. Abdomen entirely black, except some silvery lateral spots and narrow bands at incisions of segments may also be present. Legs entirely black .... *punctatus* Ricardo.
   Abdomen not entirely black or if so the legs are of lighter colour .... 9.
9. Abdomen with a large part of the dorsal surface black, the whole surface below and the lateral margins, together with the apex of the fifth and the whole of the following segment, are reddish brown .... 10.

	Abdomen strongly banded with brown, yellow-brown, or even yellow on the second to fifth or even sixth segments, legs reddish brown	*queenslandi* Ricardo.
10.	Legs reddish brown	*rufulus* White.
	Legs entirely black	*nigricans* White.

Chrysopogon mulleri Roder.

Roder, Stett. Ent. Zeit. liii. 1892, p. 243: Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 483: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 67.

Hab. Victoria, New South Wales.

Chrysopogon crabroniformis Roder.

Roder, Berl. Ent. Zeit. xxv. 1881, p. 213: Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 483: Nicholson, Austr. Zool. v. 1927, p. 47: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 67.

Hab. Queensland.

Chrysopogon splemdidissimus Ricardo.

Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 485: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 67.

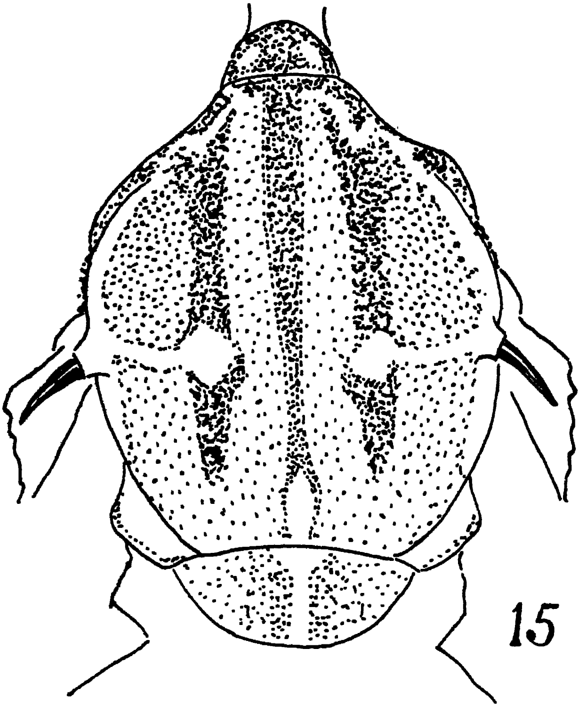
Hab. Western Australia, New South Wales, Queensland.

Chrysopogon horni, sp. n. (Fig. 15.)

Male.—Black with golden face, yellow moustache, and third to sixth abdominal segments bright yellow above, except at the lateral edges. Also the second to fourth segments have on each side a bright, almost white lustrous spot. The thorax is marked with a light grey pulverulent covering interspersed with a deep velvety brown in conformity with the figure illustrating the pattern. The legs are very dark, almost black-brown. The wings are irregularly infuscated, very heavily so at the base and about the centre of the costal area, but there is a long hyaline streak between the radial and median veins, the portion beyond the radio-median cross-vein being exceptionally obvious. Two further noticeably clear spots are at the tip of the wing. The venation is simple, all cells being open, and the radio-median cross-vein is situated at two-thirds the length of the median cell.

Hab. Queensland: Herberton, 2 males from the Deutsches Entomologisches Institut, Berlin, to where the type is returned.

NOTE.—This species is named after Dr. H. W. Horn, the Director of that Institute, and with whose permission the second specimen is retained in Australia.



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Chrysopogon horni, sp. n. Thoracic markings.

Chrysopogon albopunctatus Macquart.

Dasypogon albopunctatus Macquart, Dipt. Exot. suppl. 1, 1844, p. 65: Walker, List Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 478.
Laparus albopunctatus Schiner, Verh. zool.-bot. Ges. Wien, xvii. 1867, p. 369.
Neolaparus albopunctatus Kertesz, Cat. Dipt. iv. 1909, p. 119.
Chrysopogon albopunctatus Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 482: Dakin & Fordham, Ann. & Mag. Nat. Hist. (9) x. 1922, p. 524: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 67.
Dasypogon spinther Walker, List. Dipt. Brit. Mus. ii. 1849, p. 337 vi. suppl. 2, 1854, p. 478.

Hab. Western Australia.

Chrysopogon punctatus Ricardo.

Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 484: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 67.

Hab. Queensland.

Chrysopogon fasciatus Ricardo.

Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 483: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 67.

Hab. Queensland.

Chrysopogon conopsoides Fabr.

Asilus conopsoides Fabricius, Syst. Ent. 1775, p. 795; Sp. Ins. ii. 1781, p. 466; Mantissa Ins. ii. 1787, p. 361: Oliver, Encyclopédie Méthodique, iv. 1787, p. 270: Gmelin, Syst. Nat. v. 1792, p. 2900: Fabricius, Ent. Syst. iv. 1794, p. 389.

Diotria conopsoides Fabricius, Syst. Antl. 1805, p. 151: Wiedemann, Dipt. Exot. 1821, p. 182: Ausseurop. zweifl. Ins. i. 1828, p. 367: Walker, List Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 389: Schiner, Verh. zool.-bot. Ges. Wien, xvi. 1866, p. 675: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 352.

? *Codula conopsoides* Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 61.

From a drawing of the abdomen giving shape and colour-markings, and supplied by Miss D. Aubertin, together with further information supplied by Mr. F. W. Edwards and Mr. F. Barnett, there can be no disputing the position of this species, which is an undoubted *Chrysopogon*. Furthermore, it is possible to place its position in the key. Specimens I have seen recently from North Queensland approach it very closely, but none agree sufficiently well with the sketch to permit me placing them as conspecific.

Hab. ? Queensland.

Chrysopogon queenslandi Ricardo.

Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 484: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 68.

Hab. Queensland.

Chrysopogon rufulus White.

White, Proc. Roy. Soc. Tasmania, 1913, p. 268: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 68.

Hab. Western Australia.

Chrysopogon nigricans White.

White, Proc. Roy. Soc. Tasmania, 1913, p. 268: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 68.

Hab. Western Australia.

Chrysopogon pallidipennis White.

White, Proc. Roy. Soc. Tasmania, 1917, p. 72: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 68.

Hab. New South Wales (not seen by me).

Chrysopogon rubripennis White.

White, Proc. Roy. Soc. Tasmania, 1917, p. 73: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 68.

Hab. Victoria (not seen by me).

Genus OPSEOSTLENGIS White.

White, Proc. Roy. Soc. Tasmania, 1913, p. 269: Hardy, Proc. Linn. Soc. N.S. Wales, xlvi. 1921, p. 288; Proc. Roy. Soc. Queensland, xli. 1929, p. 68.

Opseostlengis insignis White.

White, Proc. Roy. Soc. Tasmania, 1913, p. 269: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 69.

Hab. Western Australia.

Genus CODULA Macquart.

Macquart, Dipt. Exot. suppl. 4, 1849, p. 70: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 149: Hardy, Proc. Linn. Soc. N.S. Wales, xlvi. 1921, p. 292; Proc. Roy. Soc. Queensland, xli. 1929, p. 61.

As Macquart has given a figure for this genus, there can be little doubt concerning its identity, nevertheless there are one or two slight discrepancies in the description, such as the moustache is white, not black. That he should have placed it with a species of *Brachyrrhopala* (namely, *fenestrata*) is not surprising, but here again he made an error by putting "jambes antérieures à extrémité noire sans ergots"; the spur is absent in this genus, but on *Brachyrrhopala* it is present. Apparently the genus was not recognized by Miss Ricardo, except for a species placed in it by Thomson, and which may possibly be a *Chrysopogon.* Specimens named under Thomson's specific name in Australian collections are the typical species of this genus, but information received from Miss D. Aubertin leads me to suggest that the species identified by Ricardo, in the British Museum, may be quite a different form.

Codula limbipennis Macquart.

Macquart, Dipt. Exot. suppl. 4, 1849, p. 70: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 149: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 61.

Hab. New South Wales, Queensland.

SPECIES NOT RECOGNIZED IN AUSTRALIA.

Codula vespiformis Eugenies Resa Dipt. 1869, p. 464: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 150 (nec Nicholson and Tillyard, who illustrate *C. limbipennis* Macq. under Thomson's specific name).

Tribe BRACHYRRHOPALINI Hardy.

Hardy, Proc. Linn. Soc. N.S. Wales, li. 1926, p. 307; lii. 1927, p. 394 (in part).

The affinities of this tribe would seem to be with genus *Austrosaropogon*, and not with genus *Codula*, which it superficially resembles. The thorax has a definite chætotaxy traceable, but any, and even many, of the bristles may be reduced and hair-like. They range up to 2 notopleurals, 3 supra-alars, 3 postalars, and 3 dorsocentrals each side of the median line; three pairs of scutellar bristles may be well defined amongst several hairs, but may be weak and hair-like. The metapleura is hairy. Upper forceps are apparently not developed, but the terminalia have not yet been dissected. There is only one genus yet recognized, and up to eight species in collections come into it.

Genus BRACHYRRHOPALA Macquart.

Brachyrrhopala Macquart, Dipt. Exot. suppl. 2, 1847, p. 35: Walker, List Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 493: Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 486: White, Proc. Roy. Soc. Tasmania, 1916, p. 156; 1917, p. 74: Hardy, Proc. Linn. Soc. N.S. Wales, xlvi. p. 292; li. 1926, p. 307: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 62.

Cabasa Walker, Ins. Saund. Dipt. i. 1850, p. 100; List Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 489: Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 479: White, Proc. Roy. Soc. Tasmania, 1916, p. 155: Hardy, Proc. Roy. Soc. N.S. Wales, xlvi. 1921, p. 291: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 61 (subgenus).

Key to the Species of Brachyrrhopala.

1.	Black with rather soft sclerites, and strongly gibbous red thorax with black markings ...	*pulchella* Macquart.
	Otherwise marked and with hard sclerites; black, black and red or black and yellow...	2.
2.	Segments 4 to 6 of abdomen red (fades to reddish yellow), elsewhere mainly black....	*semirufa* Hardy.
	Abdomen banded	3.
3.	Yellow of abdomen restricted to narrow bands at the apex of second, third, and sixth segments	*ruficornis* Macquart.

Markings of abdomen not so limited .... 4.
4. Yellow on second abdominal segment restricted to an apical band .... *fenestrata* Macquart.
Second abdominal segment mainly yellow ... *quadricinctus* Bigot.

Brachyrrhopala pulchella Macquart.

Dasypogon pulchellus Macquart, Dipt. Exot. suppl. 1, 1844, p. 62.
Cabassa pulchella Walker, List Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 499: Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 479: White, Proc. Roy. Soc. Tasmania, 1916, p. 155: Hardy, Proc. Linn. Soc. N.S. Wales, xlv. 1920, p. 185.
Brachyrrhopala pulchella Hardy, Proc. Linn. Soc. N.S. Wales, li. 1926, p. 307; lii. 1927, p. 394: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 63.
Dasypogon venno Walker, List Dipt. Brit. Mus. ii. 1849, p. 359; vi. suppl. 2, 1854, p. 500.
Cabasa rufithorax Walker, Ins. Saund. Dipt. i. 1850, p. 100; vi. suppl. 2, 1854, p. 499.
Dasypogon rubrithorax Macquart, Dipt. Exot. suppl. 4, 1849, p. 66.
Cabasa rubrithorax Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 480: White, Proc. Roy. Soc. Tasmania, 1916, p. 155.

Hab. Tasmania, Victoria, New South Wales, and Queensland.

Brachyrrhopala semirufa Hardy.

Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 65.

Hab. Queensland.

Brachyrrhopala ruficornis Macquart.

Macquart, Dipt. Exot. suppl. 2, 1847, p. 36: Walker, List Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 494: Roder, Wien. Ent. Zeit. ii. 1883, p. 273: Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 586: White, Proc. Roy. Soc. Tasmania, 1916, p. 158: Hardy, Proc. Roy. Soc. Tasmania, 1917, p. 66; Proc. Roy. Soc. Queensland, xli. 1926, p. 63; Proc. Linn. Soc. N.S. Wales, lii. 1927, p. 394.

This species, together with the two following ones, may represent a variable form, distinguishable from other species in collections and that are intimately allied by the antennal proportions. All these are rather scarce and cannot be reviewed with advantage.

Hab. Tasmania.

Brachyrrhopala fenestrata Macquart.

Codula fenestrata Macquart, Dipt. Exot. suppl. 4, 1849, p. 70.
Brachyrrhopala fenestrata Ricardo, Ann. & Mag. Nat. Hist. (8) 1912, p. 586: White, Proc. Roy. Soc. Tasmania, 1916, p. 157: Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 64.
Brachyrrhopala victoriæ Roder, Stett. Ent. Zeit. liii. 1892, p. 241.

Hab. Tasmania, Victoria.

Brachyrrhopala quadricincta Bigot.

? *Dasypogon nigrinus* Macquart, Dipt. Exot. suppl. 4, 1849, p. 66: Ricardo, Ann. Mag. Nat. Hist. (8) x. 1912, p. 351.
Codula quadricincta Bigot, Ann. Ent. Soc. France, (5) viii. 1878, p. 442: Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 588.
Brachyrrhopala quadricincta Hardy, Proc. Roy. Soc. Queensland, xli. 1929, p. 64.
Brachyrrhopala fulva Ricardo, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 588: Hardy, Proc. Linn. Soc. N.S. Wales, lii. 1927, p. 394.

Hab. Queensland and New South Wales.

SPECIES OF *DASYPOGONINÆ* WHICH HAVE NOT BEEN ASSIGNED TO A POSITION.

Deromyia australis Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 142.

The generic position of *Deromyia* is uncertain, but this species placed there by Ricardo may belong to the *Thereutria-Rachiopogon* group.

Hab. Queensland.

Microstylum testaceum Macquart, Dipt. Exot. suppl. 1, 1844, p. 60: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 148. *Dasypogon testaceum* Walker, List Dipt. Brit. Mus. vi. suppl. 2, 1854, p. 482.

The genus in which Macquart placed it suggests *Bathypogon*, but the description of the species hardly agrees with that.

Hab. ? New South Wales.

Damalis fuscipennis Macquart, Dipt. Exot. suppl. 1, 1844, p. 95: Walker, List Dipt. Brit. Mus. vii. suppl. 3, 1855, p. 765: Ricardo, Ann. & Mag. Nat. Hist. (8) x. 1912, p. 159.

Hab. Australia.

II.—*New Æthiopian Bees of the Subfamily* Anthidiinæ (*Apoidea*). By G. A. MAVROMOUSTAKIS, Limassol, Cyprus.

THE present paper is based on an interesting collection of Æthiopian Anthidiine bees kindly loaned to me by the British Museum. To Mr. Robert B. Benson, of the British Museum, I am greatly indebted for his generous aid in interpreting for me certain of Smith's types of

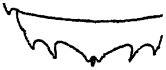
Anthidium in the Museum. Although I recognize that some of the new species here described are not really members of *Anthidium* (s. str.), I am treating them under that genus, leaving the discussion of their generic position to a forthcoming paper. The types of the new species and the new variety are placed in the British Museum.

Anthidium hoplogastrum, sp. n. (Fig. 1.)

Female.—Length nearly 8 mm., breadth of abdomen 3·4 mm.

Superficially like *Anthidium reicherti* Brauns, but without spines at sides of tergites 3 to 5. Black. A linear stripe along inner orbits to the top, a very short stripe above top of eyes, yellow; mandibles yellow, teeth black-brown; antennæ black; third antennal joint longer than second or fourth, but shorter than 4+5; fifth longer than fourth. Head finely and densely punctured; clypeus shining, somewhat convex, finely and densely punctured with a median longitudinal impunctate and shining line reaching the upper part of supra-clypeal area; front, sides of face, clypeus, cheeks with white hairs; vertex and occiput with dense and long pale fulvous hairs. Mesonotum opaque, densely punctured; scutellum normal, rounded, without median depression; tegulæ pale yellow, with brown middle and subhyaline margin; pilosity on thorax sparse and yellowish white above, abundant and white at sides. Wings clear, upper half of marginal cell clouded; second recurrent nervure very slightly out of second transverse cubital nervure. Anterior femora black above and orange beneath; middle and hind femora (except the black base of middle femora beneath) and all tibiæ orange; middle tarsi brown and last small joint orange; hind tarsi black-brown (except the orange last small joint) and covered with dense fulvous hairs on inner side; a black spot at base on inner side of tibiæ above; no pulvilli; spurs yellowish. Abdomen black and shining, densely punctured, the punctures very dense and fine a little above the impunctate and shining black-brown apical margins; tergites 1 to 5 with a transverse narrow and impunctate creamy-yellow stripe (the stripe on tergites 3 to 5 sparsely punctured); a narrow reddish stripe below the yellow on second and third tergites (the reddish stripe broader on third), and a reddish suffusion between the yellow stripe and the apical margin of fourth and fifth; sixth tergite with a broad yellow stripe not reaching sides; fourth tergite laterally angulate and fifth with a small reddish spine at sides; sixth tergite with four acute spines (lateral black and inner reddish) and the apical middle divided in two very small blunt spines; the apical middle of sixth ventral segment with a short spine which is slightly projected between the median blunt dorsal spines (fig. 1); a tuft of white hairs at sides of first tergite and some sparse and short white hairs on rest of abdomen above; ventral scopa dense, rufous and white at sides.

Fig. 1.



Fifth and sixth abdominal tergites of *Anthidium hoplogastrum*, sp. n., ♀.

Type, Cape Province, Matjesfontein, 16–21. x. 1928, ♀ (*R. E. Turner*).

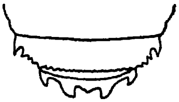
Anthidium pœcilodontum, sp. n. (Fig. 2.)

Male.—Length 8·5 mm., breadth of abdomen 3 mm.

Black. Clypeus, a short basal and transverse supraclypeal stripe, lateral face-marks (filling space between clypeus and eyes) reaching level of insertion of antennæ and narrowing to a line along inner orbits nearly to the top, a minute spot above top of eyes, cream; scape, second and third antennal joints black, rest of flagellum obscurely brown beneath and black above; third joint longer than second or fourth, but shorter than 4+5; fifth somewhat longer than fourth. Head densely punctured and shining; front, sides of face, clypeus covered with creamy-white hairs; some short white hairs on cheeks. Thorax black and shining, somewhat densely punctured, axillæ finely and densely punctured; tegulæ black-brown, creamy white in front; scutellum normal and rounded, apical margin yellow; mesonotum with long and dull yellowish-white hairs not covering surface;

sides of thorax covered with long and dense shining white hairs. Wings clear, upper half of marginal cell clouded; second recurrent nervure slightly enclosed in the second cubital cell nearly to the base of second transverse cubital nervure. Coxæ black; femora black, with an orange stripe from base to apex beneath (the orange stripe on hind femora short); tibiæ black, with an orange stripe not reaching apex above; the orange stripe on tibiæ with a yellow spot at base; anterior tarsi black except the yellowish-white apex of basitarsi and the orange third and fourth small joints; middle tarsi black, fourth small joint orange; hind tarsi black; spurs yellowish white; legs with some creamy-white hairs; hind basitarsi with dense pale fulvous hairs; no pulvilli. Abdomen black and shining; basal region of tergites somewhat densely punctured, but a little above the impunctate apical margins finely and densely punctured; between basal and apical regions the punctation strong and sparse; first tergite with a small lateral pale yellow mark; tergites 2 to 5 with a transverse entire and narrow creamy-yellow stripe; sixth tergite with a broad pale yellow stripe not reaching sides, apical margin suffused with brown; seventh tergite mostly deep yellow with a reddish-brown suffusion at sides; apical margin of sixth tergite unmodified, but a little above it, somewhat projected transversely and possessing toward sides a row of six or seven denticles terminating in a long lateral tooth; seventh tergite with four blunt spines, and between the middle ones a projected triangle not surpassing the level of the top of the median spines (fig. 2).

Fig. 2.



Fifth to seventh abdominal tergites of *Anthidium pœcilodontum*, sp. n., ♂.

Female.—Length 8·5 mm., breadth of abdomen 3 mm. Head black; mandibles yellowish at base, teeth black; a creamy-yellow small round spot above top of eyes; scape, second and third antennal joints black, rest brown beneath and obscure brown above; clypeus shining, slightly convex, with a median, longitudinal, impunctate and polished wide line not reaching the upper part of clypeus; lower margin of clypeus straight, with six small rounded denticles; front, sides of face, cheeks with some white hairs; some yellowish-white hairs on vertex; venation abnormal, as in the male; no pulvilli. Abdomen very elongate and unarmed; apical margin of sixth tergite subcrenulate and rounded; tergites 1 to 5 with an entire transverse creamy-yellow stripe not reaching sides; ventral scopa white; sides of abdomen with some white hairs; anterior and middle tibiæ with the orange stripe reaching apex; small tarsal joints 3 to 5 orange.

Type, Cape Province, Matjesfontein, 25–30. x. 1930, ♂ (*R. E. Turner*); *allotype*, Cape Province, Matjesfontein, 25–30. x. 1928, ♀ (*R. E. Turner*).

Superficially it resembles *Anthidium hoplogastrum* Mavrom., but is very distinct owing to the unarmed abdomen of the female, the elongate abdomen in both sexes, and the peculiar structure of the last abdominal tergites of the male. I find no near relative in the Æthiopian fauna. The venation is abnormal in both sexes, looking like *Megachile*, but I cannot see any other characters that will separate it from *Anthidium* (s. str.).

Anthidium matjesfonteinense, sp. n. (Figs. 3 & 4.)

Female.—Length 7 mm., fore wing 6 mm.

Black. A very small yellow mark above top of eyes; 4-dentate mandibles reddish brown, teeth black; antennæ black, flagellum suffused with brown beneath; third antennal joint somewhat longer than fourth, but shorter than 4+5; fourth and fifth equally long. Head shining; vertex and cheeks with strong but somewhat separated punctures; front, sides of face, clypeus with dense and shining white hairs; some short yellowish hairs on occiput. Thorax shining, with strong well-separated punctures; area of metathorax shining, finely and densely punctured above and at sides, rest impunctate and shining; scutellum rounded at sides, with a lateral yellow stripe; tegulæ black on inner side, rest brown with a creamy-white mark in front; some sparse and short white hairs on thorax above and dense shining white at sides. Wings very dusky; second recurrent nervure slightly out of second transverse cubital nervure. Femora black and apically orange; tibiæ and tarsi orange; hind tarsi with basitarsi and small joints brown; legs with some white hairs; hind basitarsi densely covered with fulvous hairs on inner side; no pulvilli. Abdomen black and shining, strongly and sparsely punctured; apical margin of tergites 1 to 5 impunctate and shining; first tergite with a creamy-yellow lateral spot and a creamy-yellow stripe between the spots, but broken in the middle; tergites 2 to 4 with a transverse and narrow creamy-yellow stripe not reaching sides; tergites 5 to 6 black; a tuft of shining white hairs at sides of tergites 1 to 5; ventral scopa black.

Male.—Length 7·5 mm.

Black; mandibles yellow, teeth black-brown; anterior femora with an orange stripe reaching apex beneath; anterior and middle tibiæ basally and apically marked with yellow; first abdominal tergite with a narrow pale yellow stripe divided into four; tergites 2 to 4 with a narrow pale yellow stripe (the stripe on fourth broad in middle); fifth tergite black at base, with a brown suffusion, rest pale yellow; sixth and seventh tergites pale yellow; apical margins of tergites black or black-brown, those of tergites 2 to 5 subhyaline and mostly yellowish; sixth tergite rounded laterally, apical margin straight; seventh tergite rounded at sides and with two median spines; between the spines an incision (fig. 3); ventral segments densely covered with long whitish hairs.

Fig. 3.

Fig. 4.

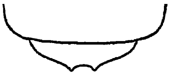


Fig. 3.—Sixth and seventh abdominal tergites of *Anthidium matjesfonteinense*, sp. n., ♂.

Fig. 4.—Sixth and seventh abdominal tergites of *Anthidium junedi* Friese, ♂.

Type ♀, *allotype* ♂, Cape Province, Matjesfontein, 1–6. xi. 1928 (*R. E. Turner*); 2 ♂ *paratypes*, Matjesfontein, 1–6. xi. 1928 (*R. E. Turner*), are similar to the allotype, but the pale yellow on fifth tergite medianly notched at base or at basal lateral half by black or reddish brown; middle femora with an obscure mark toward base and apex above.

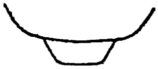
Of the known Æthiopian *Anthidium* species, the nearest seems to be *Anthidium junedi* Friese (*Anthidium eurysomum* Cam., *A. melanosomum* Cam.), but that species has white scopa and the last abdominal tergites of the male are different (fig. 4). *Anthidium junedi* may be referred to *Anthidium* (s. str.), while *Anthidium matjesfonteinense*, sp. n., is a member of a group related to the South American *Hypanthidium.*

Anthidium platyscepum, sp. n. (Fig. 5.)

Female.—Length 5·5 mm.

Superficially like *Anthidium minutulum* Brauns. Black. Head shining; mandibles except the black-brown teeth, lateral face-marks (filling space between clypeus and eyes) truncate above to the level insertion of antennæ, pale yellow; a short basal and transverse supraclypeal stripe, cheeks, and entire occipital stripe, deep yellow; scape black, base reddish brown, apex yellowish beneath; second antennal joint black except the apex, base of third black and suffused with brown; otherwise flagellum light reddish brown; second joint longer and wider than third; third somewhat longer than fourth, but shorter than 4+5; fourth or fifth equally long and wider than third; clypeus without smooth line; head finely and densely punctured; vertex finely and somewhat sparsely punctured; no hairs on head except some short and white on lower margin of clypeus. Thorax black; scutellum projected as in *Anthidium minutulum*, rounded at sides and subemarginate in middle; sides of scutellum with a broad pale yellow stripe reaching middle; axillæ and tubercles pale yellow; a short pale yellow stripe at sides of mesonotum above, not reaching middle; tegulæ impunctate, reddish yellow, with a yellowish-white

Fig. 5.



Sixth and seventh abdominal tergites of *Anthidium platyscepum*, sp. n., ♂.

mark and subhyaline margin in front; mesonotum dullish, with sparse and strong punctures; area of metathorax shining, minutely and densely punctured, sides finely and somewhat sparsely punctured; thorax with some white hairs at sides. Wings clear; second recurrent nervure out of second transverse cubital nervure. Anterior and middle femora light reddish brown above and yellow beneath; coxæ and hind femora light reddish brown; tarsi light yellow; hind tarsi with basitarsi and small joints yellowish brown and covered with golden hairs on inner side; spurs yellowish; first and second tergites black, with a transverse ochreous stripe, and between the ochreous stripe and apical margin the region yellowish with a slight brown suffusion; coloration on third tergite as on the preceding, but the ochreous stripe broad and covering sides; lateral half of the ochreous stripe on first and second tergites medianly interrupted by reddish-brown suffusion; tergites 4 to 6 ochreous (with a slight brown suffusion toward the apex of sixth tergite); ventral segments light reddish brown; scopa white.

Male.—Length 5·5 mm.

Clypeus, supraclypeal area, mandibles except black-brown teeth, lateral face-marks, scape beneath, lemon-yellow; second antennal joint except apex black, rest of flagellum mostly light reddish brown with a yellowish-brown suffusion on joints 3 to 5 beneath; front, sides of face, clypeus with shining white hairs; some short pale fulvous hairs on vertex and occiput; mesonotum with some sparse and short yellowish-white hairs in front; hind femora light reddish brown, with a light yellow stripe beneath (lacking in certain paratypes); tarsi light yellow; no pulvilli; second recurrent nervure out of second transverse cubital nervure; between the ochreous stripe and apical margin of first and second tergites the region yellowish; third tergite ochreous, basal region black; tergites 4 to 7 ochreous; sixth tergite unarmed and rounded at sides; seventh tergite sufficiently projected and truncate (fig. 5); ventral segments light reddish brown with white hairs.

Type ♀, *allotype* ♂, S.W. Africa, Aus, December 1929 (*R. E. Turner*); 4 ♂ *paratypes*, Aus, December 1929 (*R. E. Turner*); a ♂ *paratype*, Aus, January 1930 (*R. E. Turner*), differs from allotype as follows:—Base of third abdominal tergite light reddish brown; between the ochreous stripe and apical margin of first tergite the region light reddish brown; base of second tergite laterally light reddish brown; 2 ♂ *paratypes*, Aus, December 1929 (*R. E. Turner*), similar to allotype, but with the base of third tergite light reddish brown.

Related to *Anthidium absenulum* Ckll., from Katanga, Belgian Congo, but the last is somewhat larger, with black antennæ, dusky wings, black and punctured tegulæ, strong and dense punctation, and different colour. It differs from *Anthidium rebellum* Brauns through the absence of a smooth line on the clypeus, and from *Anthidium rubellulum* Ckll. by its smaller size and many colour and structural details. *Anthidium minutulum* Brauns possesses a rufous clypeus, fulvous scopa, shining mesonotum, and in the male an emarginate seventh tergite.

Dianthidium turnericum, sp. n. (Fig. 6.)

Male.—Length 7·5 mm.

Looking like *Anthidium armaticeps* Friese. Head and thorax black; clypeus broader than long, convex, well punctured and shining, deep yellow, with four very small and hardly visible tubercles on lower margin; mandibles briefly 4-dentate, yellow, with black-brown teeth; lateral face-marks (filling space between clypeus and eyes) reaching level of insertion of antennæ, and then narrowing along inner orbits to the top, deep yellow; cheeks, entire occipital stripe attenuated in middle, an oval mark below middle ocellus, supraclypeal area (slightly suffused with reddish brown), deep yellow; between antennæ at each side a short longitudinal deep yellow ridge not surpassing the upper part of supraclypeal area; vertex shining, strongly and densely punctured; antennæ mostly reddish brown; third antennal joint hardly longer than fourth; fourth shorter than fifth; clypeus, sides of face with some yellowish-white hairs; vertex, occiput with some very sparse and short fulvous hairs. Scutellum united with axillæ, abruptly projected, rounded at sides and subemarginate in middle; axillæ and hind margin of scutellum yellow with an reddish-brown suffusion; a L-shaped broad yellow stripe at sides of mesonotum reaching axillæ; tegulæ punctured and yellow except the yellowish-brown middle; tubercles yellow and covered with flat-lying scale; mesonotum shining, strongly and densely punctured, the punctures stronger than those on vertex; area of metathorax shining, finely and somewhat sparsely punctured above. Wings slightly dusky; second recurrent nervure out of second transverse cubital nervure. Mesopleura yellow in front; thorax with some very short light fulvous hairs above; coxæ, femora light reddish brown; anterior and middle femora with a yellow stripe beneath; tibiæ yellow except for a reddish-brown suffusion on inner side of hind ones; tarsi mostly yellow; hind basitarsi with dense golden hairs on inner side; spurs yellow; pulvilli well developed. Abdomen shining, sparsely punctured; the punctures at sides of first tergite strong, and those a little above the impunctate and shining apical margin fine; first tergite light reddish brown, with a lateral yellow mark nearly covering sides; second and third tergites light reddish brown, with a yellow lateral stripe covering sides and nearly reaching middle (third with a yellow stripe medianly attenuated in the paratype); fourth and fifth tergites mostly yellow, with a transverse and very narrow light reddish-brown stripe above apical margin; the yellow on fourth tergite medianly interrupted by reddish brown, and that on fifth with a median obscure spot at base; fifth tergite unarmed and rounded laterally; sixth tergite yellow, with irregularly subcrenulated apical margin; sixth ventral segment with a small reddish-brown carina reaching apex; ventral segments light reddish brown; ventral scopa light golden.

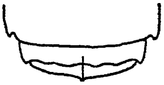
Male.—Length 8·5 mm.

Mandibles except teeth, clypeus, supraclypeal area, lateral face-marks (except the deep yellow upper part), lemon-yellow; the spot below median ocellus, cheeks, and entire occipital stripe deep yellow; flagellum with dark brown suffusion mostly toward apex; abdominal tergites 1 to 3 light reddish brown, with a large yellow mark covering sides; fourth tergite reddish brown, with a broad medianly interrupted yellow stripe; fifth and sixth tergites suffused with light reddish brown; sixth tergite with a lateral small tooth; the middle of seventh tergite somewhat projected transversely and subsinuated, and terminating in a small lateral lobe; seventh tergite with a slight median longitudinal carina, which is slightly projected over the apex of its hidden and rounded apical margin (fig. 6).

Type ♀, *allotype* ♂, S.W. Africa, Aus, January 1930 (*R. E. Turner*); *paratypes* ♀♂, Aus, January 1930 (*R. E. Turner*).

Related to *Anthidium armaticeps* Friese, but in the last species the lower margin of the clypeus possesses two large, rounded, and projected tubercles. *Dianthidium turnericum*, sp. n., is a real member of the North-American *Dianthidium* with the characteristic flat-lying scale over the tubercles. The spines are, however, lacking in both sexes, and the scutellum is projected and rounded laterally.

Fig. 6.



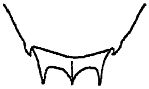
Sixth and seventh abdominal tergites of *Dianthidium turnericum*, sp. n., ♂.

Anthidiellum ausense, sp. n. (Fig. 7.)

Male.—Length 7–7·5 mm.

Head and thorax black; clypeus, lateral face-marks (filling space between clypeus and eyes) reaching insertion of antennæ and then narrowing to a line along inner orbits nearly to the top, deep yellow; a spot below median ocellus, cheeks, entire occipital stripe, yellow; base of supraclypeal area slightly suffused with reddish brown; occiput subhyaline, somewhat projected over mesonotum and yellowish; scape and second antennal joint black, with reddish-brown apex; third and fourth joints reddish brown, rest of flagellum brown beneath and obscure brown above; third joint shorter than 4+5; head shining; vertex with strong somewhat separated punctures, the punctures between ocelli less strong and sparse; a small polished space near the sides of anterior ocelli; vertex with some short fulvous hairs; pilosity on head dense and shining white in front. Thorax black and shining; scutellum abruptly projected over metathorax, sharply edged and rounded laterally; between axillæ and scutellum slightly incised; apical margin of scutellum and axillæ yellow; a reddish-brown stripe at sides of mesonotum, reaching axillæ and upper part of tegulæ; tubercles yellowish and slightly erected in front; tegulæ light reddish brown, with pale yellow and subhyaline margin in front; mesonotum with strong punctures, scutellum with coarse and well-separated punctures; area of metathorax shining, finely and densely punctured. Wings clear, upper half of marginal cell and apical margin slightly clouded; second recurrent nervure out of second transverse cubital nervure. Pilosity on thorax very scanty and yellowish white above, abundant and white at sides; anterior and middle femora yellow beneath and light reddish brown above; hind femora light reddish brown, with a narrow yellow stripe beneath; apex of femora yellow above; tibiæ and tarsi yellow (inner side of hind tibiæ suffused with light reddish brown); some short and white hairs on legs; inner side of hind basitarsi with dense light golden hairs; spurs yellow; pulvilli well developed. Abdomen shining; first and second tergites strongly and sparsely punctured, rest of tergites finely and sparsely punctured; apical margin of tergites 1 to 5 impunctate and shining; first and second tergites reddish brown, with a transverse impunctate creamy-yellow stripe (suffused with yellow toward sides of second); third tergite reddish brown, with a transverse, somewhat impunctate, and narrow yellow stripe; fourth and fifth tergites yellow, with a narrow reddish-brown stripe a little above apical margin; sixth tergite yellow and suffused with brown on apical margin; seventh tergite yellow; sixth tergite with a pointed and curved tooth near the sides; sides of base of seventh tergite angulate, apical margin with two lateral straight and acute spines, and between them a triangle terminating in a spine which is on the same level as the lateral ones;

Fig. 7.



Sixth and seventh abdominal tergites of *Anthidiellum ausense*, sp. n., ♂.

a carina occupies all the median projection and reaches the base of seventh tergite (fig. 7); sixth ventral segment flat, with rounded apical margin and angulate sides; ventral segments with dense white hairs; a transverse row of short golden bristles a little above apical margin of tergites 3 to 5.

Type, S.W. Africa, Aus, January 1930, ♂ (*R. E. Turner*); 4 ♂ *paratypes*, Aus, January 1930 (*R. E. Turner*), agree with the type, but with the following differences:—Supraclypeal area basally with two lateral and a median reddish-brown spot or a median reddish-brown very small spot; scape and second antennal joint black, rest of flagellum mostly reddish brown; apical margin of first tergite and basal margin of second, black or basal region of third, black; fourth and fifth tergites light reddish brown, with a broad, median, transverse yellow stripe or the yellow stripe interrupted in middle and at lateral half by a light reddish-brown suffusion; seventh tergite mostly light reddish brown, with the lateral spines yellow.

This very interesting species, owing to its abruptly projected and sharply edged scutellum, would appear to be a member of *Pachyanthidium* Friese, but the presence of well-developed pulvilli excludes it from that genus. It is undoubtedly a member of *Anthidiellum* Cockerell, owing to the presence of erect tubercles, but I think it belongs to a distinct African group.

Anthidium ferrugineum F. var. *azarense*, nov.

N. Nigeria, S.E. Kano, Azare (*Dr. Ll. Lloyd*).

I have compared the new variety with specimens of *Anthidium ferrugineum* F. from Spain (Dusmet, *Giner*), and have found the following differences:—Mandibles except teeth, clypeus, lateral face-marks, a supraclypeal stripe, entire occipital stripe, cheeks, scape beneath, scutellum, axillæ, tegulæ except median reddish mark, sides of mesonotum, all yellow; anterior and middle femora yellow beneath; tibiæ and tarsi yellow (except the reddish small tarsal joints); first abdominal tergite reddish, with a broad transverse yellow stripe; rest of tergites yellow except a basal median reddish mark on second and a reddish suffusion toward apical margin of tergites 2 to 4.

The new variety is related to the Egyptian "*Anthidium ferrugineun subzonatum* Alfken" (in Bull. Soc. Ent. Egypte, 1932, fasc. 3, p. iii), but is distinct owing to the rich extension of yellow.

All drawings for this paper have been executed, under my supervision, by the artist Mr. V. N. Joannidi, to whom I am indebted.

III.—*Oxford University Hudson Strait Expedition to Akpatok Island, Ungava Bay,* 1931.—*Lepidoptera.* By Prof. EDWARD B. POULTON, D.Sc., F.R.S., Fellow of Jesus College, Oxford.

ALTHOUGH the species of Lepidoptera collected or observed were but few, these records from Akpatok Island—never before visited by a naturalist—are of great interest, and one much enhanced by the full and excellent data. Mr. D. H. S. Davis has written the following account of the conditions under which the collection was made, and has added the notes upon each of the species :—

"Owing to the lateness of the season when the Expedition arrived at the island on 18 August 1931 and also to the gales and bad weather prevalent in these regions, the Lepidoptera were in very poor condition, and after a few days the butterflies disappeared altogether, while no moths were seen after the end of the month. The island consists of a bare level plateau, 600–900 ft. above sea-level, with ravines and valleys cutting down to the sea. On the plateau itself the only Lepidopterous insect seen was the Geometrid moth, *Entephria polata,* which had evidently been blown from the sheltered valleys by strong winds."

A few of the Lepidoptera are specially noted as having been taken in southern Akpatok, all others being from the south-east of the island. All were captured by Mr. D. H. S. Davis and Mr. A. K. Gregson. The species were kindly determined by Mr. N. D. Riley and Mr. W. H. T. Tams of the British Museum (Nat. Hist.). In the verification of data much kind help was given by Dr. B. M. Hobby, D.Phil., and Mr. E. Taylor of the Hope Dept., Oxford University Museum.

RHOPALOCERA.

Brenthis chariclea obscurata McLach.

Not seen after Aug. 22. Confined to the more sheltered valleys better supplied with vegetation. Rather commoner on the lower part of slopes near streams.

(S. Akpatok.) 20 Aug.: rough valley slope.—Specimen no. 2.

20 Aug.: herbaceous valley slope, 3 m. N. of camp, flying.—Nos. 4, 5, 13.

21 Aug.: herbaceous valley slope.—Nos. 26, 29, 30 (all on slope facing S.); 31, nr. camp.

22 Aug.: slopes at valley head.—No. 45.

Colias hecla hecla Lefebr. = *grœnlandica* Lampa.

Not taken after Aug. 25. Also confined to the valleys better supplied with vegetation, but more frequently found in marshy areas and terraces towards the heads of valleys. All males unless otherwise indicated.

20 Aug: herbaceous valley slope, 3 m. N. of camp, flying.—Nos. 6, 7 (♀), 8, 9, and 12 (♂♀ in cop.), 10, 11.

21 Aug.: herbaceous valley slope, facing S.—Nos. 24, 25, 27, 28.

22 Aug.: slopes at valley head.—Nos. 44, 46.

25 Aug.: marsh at valley head.—Nos. 100, 101, 102.

HETEROCERA.

Apantesis quenselii Hübn. (**Arctiidæ.**)

This species had already disappeared by August 18, as the only one found was dead and no other was seen. Their apparently omnivorous larvæ were, however, very numerous, more particularly on the plateau, where they were feeding on the *Salix polaris*, *Dryas integrifolia*, etc.

(S. Apatok.) 18 Aug.: nr. watercourse.—No. 1 (dead).

Two tubes of larvæ.—No. 281.

Sympistis zetterstedtii Stgr. (**Noctuidæ:** *Cuculliinæ.*)

Common in the valleys. Taken flying on sunny days and under stones on dull days. It was as common on rough slopes as on those with more vegetation.

20 Aug.: herbaceous valley slope, nr. camp, flying. —No. 15.

21 Aug.: herbaceous valley slope.—Nos. 36, 37, 38, 39.
22 Aug.: slopes at valley head.—No. 47.
25 Aug.: herbaceous valley slope, under stone.—No. 79.
25 Aug.: herbaceous valley slope, flying.—No. 81.
rough valley slope, flying.—No. 83.
28 Aug. rough valley slope.—Nos. 135, 144.
29 Aug. rough valley slope, flying.—No. 164.

Entephria polata brullei Lef. (**Geometridæ.**)

Uncommon. Found on the plateau, having been blown from the valleys where it was taken flying over stony slopes.

20 Aug.: herbaceous valley slope, nr. camp, flying.—No. 14.
22 Aug.: on plateau, about 600 ft.—No. 115.
25 Aug.: on plateau, about 600 ft., flying.—No. 103.

IV.—*Oxford University Hudson Strait Expedition to Akpatok Island, Ungava Bay,* 1931.—*Hymenoptera Parasitica, including a few Specimens taken at Port Burwell, Labrador.* By Prof. EDWARD B. POULTON, D.Sc., F.R.S.

THIS little collection includes twenty-three specimens, of which five were taken at Port Burwell in Ungava Territory, on the Labrador coast of Canada. Sixteen specimens are Ichneumonidæ, belonging to fifteen or perhaps fourteen species; seven are Braconidæ, five belonging to a single species and one each to two others. With the exception of three specimens taken by A. K. Gregson and one by J. Baxter, the whole collection was made by D. H. S. Davis.

The material was first sent to Dr. A. Roman of the Naturhistoriska Riksmuseum, Stockholm, who wrote, 20 November, 1933, concerning the Ichneumonidæ:—"It is of course very interesting to see a number of North American Arctic Ichneumons and to compare them with our collections from the Old World Arctics. I have looked at them from the European standpoint and found two [Nos. 13 and 15] to be identical with our arctic species . . . . I am not versed in the North American fauna and it would take more time than I can afford to determine whether the species are described or not .... I now return your box, sorry not to be of more use to you, but as a help to an eventual successor, I have put labels on the specimens, giving my opinions." The collection was then sent, as Dr. Roman advised, to Mr. R. A. Cushman of the U.S. National Museum, Washington, who wrote, 20 December, 1933, as follows:—"We have received the box of specimens and have examined them. In looking over the Ichneumonidæ I find that I am unable to identify any as described North American species. Dr. Roman has already identified specifically two species and has placed generic names on those that he could not identify as species. I differ from his identifications only in nomenclatorial usage of certain of the generic names, so have changed the identification on only one specimen [No. 6], a species of *Platylabus* that he had placed under *Ichneumon* .... Mr. Muesebeck has identified the Braconidæ generically, finding two species of *Apanteles* and one of *Macrocentrus*."

It is unfortunate that hardly any of the species could be determined and that no new forms could be described, but it would not be reasonable to expect descriptions of single examples in these difficult groups. On the other hand, the list of forms printed below is of exceptional interest in illuminating the conditions of life in this remote locality, suggesting as it does the existence of numerous and very varied parasites dependent upon a more abundant insect fauna than we should have inferred from the collections made by the Expedition.

The following list of the twenty-three specimens has been arranged and classified under the various groups of Parasitica by my kind friend Dr. C. Ferrière of the Natural History Museum:—

Family **Ichneumonidæ.**

Subfamily *ICHNEUMONINÆ.*

Tribe ICHNEUMONINI.

1. *Ichneumon* sp., ♀.—S.W. Akpatok, 4 Sept.—Under stone in thick lichen mat, edge of cliff, about 600 ft., plateau (*A. K. Gregson*).
2. *Ichneumon* sp., ♀.—S.E. Akpatok, 22 Aug.—Plateau, about 600 ft. (*D. H. S. Davis*).

3. *Ichneumon* sp., ♂.—Canada, Labrador, about 31 Aug.—Ungava Territory, Port Burwell, about 40 ft. (*J. Baxter*).

4. *Ichneumon* sp., ♂.—S.E. Akpatok, 25 Aug.—Flying, rough valley slope (*D. H. S. D.*).

5. *Ichneumon* sp., ♂.—S.E. Akpatok, 31 Aug.—In tent (*D. H. S. D.*). Dr. Ferrière considers it probable that this is the same species as No. 4, the two being only distinguished by slight colour differences.

6. *Platylabus* sp., ♂.—S.E. Akpatok, 29 Aug.—In dry hollow at base of scree ravine (*D. H. S. D.*).

Subfamily *CRYPTINÆ*.

Tribe PHYGADEUONINI.

7, 8. *Cratocryptus* sp., ♂ ♂.—No. 7, S.E. Akpatok, 25 Aug.—Bog margin, valley head (*D. H. S. D.*); No. 8, Ungava Terr., Port Burwell, about 40 ft., 16 Aug. (*D. H. S. D.*).

9. *Microcryptus* sp., ♀.—S.E. Akpatok, Sept. 10.—In tent (*D. H. S. D.*).

10. *Phygadeuon* sp., ♀.—Ungava Terr., Port Burwell, about 40 ft., 16 Aug. (*D. H. S. D.*).

Tribe HEMITELINI.

11. *Aclastus* sp., ♀.—S.E. Akpatok, 8 Sept.—Plant roots, slope, near bog, valley head (*A. K. G.*).

Subfamily *PIMPLINÆ*.

Tribe PIMPLINI.

12. *Delomerista* sp., ♀.—S.E. Akpatok, 25 Aug.—In moss, herbaceous valley slope (*D. H. S. D.*).

Subfamily *OPHIONINÆ*.

Tribe MESOCHORINI.

13. *Mesochorus nigriceps* Ths., ♀.—S.E. Akpatok, 11 Sept.—Rough valley slope (*D. H. S. D.*).

Tribe PLECTISCINI.

14. *Plectiscus* sp., ♀ (cf. *hyperboreus* Holmgr.).—S.E. Akpatok, 28 Aug.—Boggy dip, plateau, about 600 ft. (*D. H. S. D.*).

Subfamily *TRYPHONINÆ.*

Tribe MESOLEPTINI.

15. *Mesoleius lituratus* Holmgr. var. *sahlbergi* Woldst., ♀.—S.E. Akpatok, 21 Aug.—Rough valley slope (*D. H. S. D.*).

Tribe ORTHOCENTRI.

16. *Stenomacrus* sp., ♀. (cf. *atratus* Holmgr.).—Ungava Terr., Port Burwell, about 40 ft., 16 Aug. (*D. H. S. D.*).

Family **Braconidæ.**

Subfamily *MICROGASTERINÆ.*

17–21. *Apanteles* sp., near *alticola* Ashm.—All taken by D. H. S. Davis and all except No. 19 in S.E. Akpatok.

17. ♀, 28 Aug., moss at base of boulder, plateau, about 600 ft.
18. ♂, 28 Aug., flying on plateau, about 600 ft.
19. ♂, 16 Aug., Ungava Terr., Port Burwell, about 40 ft.
20. ♂, 28 Aug., boggy dip, plateau, about 600 ft.
21. ♀, 25 Aug., stones, rough valley slope.

22. *Apanteles* sp., ♀, near *nitens* Mues.—S. Akpatok, 1 Sept.—Plateau, about 600 ft. (*A. K. G.*).

Subfamily *MACROCENTRINÆ.*

23. *Macrocentrus* sp., ♂.—S.E. Akpatok, 28 Aug.—Flying, plateau, about 600 ft. (*D. H. S. D.*).

V.—*The Cervical Vertebræ of a Gorgonopsian* (Ælurognathus tigriceps). By LIEUWE D. BOONSTRA, D.Sc., Palæontologist, South African Museum.

IN 1913 Broom and Haughton, in their paper on *Ælurognathus tigriceps* (Ann. S. Afr. Mus. vol. xii.), mentioned the cervical vertebræ in a very brief description unaccompanied by any figures. Watson, in 1921, figured (Proc. Zool. Soc.) the proatlas, atlas, and axis of a nearly related form, *Scymnognathus whaitsi*, but gave no description.

In 1930 Broom, in his paper on the *Gorgonopsia* (Phil. Trans. Roy. Soc.), gave a short account of the imperfect cervicals of *Lycænops ornatus* (pl. xxviii. figs. 8 & 9). Broom also devotes a short paragraph to the cervicals of *Ælurognathus tigriceps*, and gives a number of figures (pl. xxviii. figs. 10, 11, 12, & 13). As I have only recently adequately removed the mass of matrix from the anterior cervicals it says much for Broom's imagination that he was able to produce figs. 10 & 11.

This short note is intended to provide an accurate account of the cervicals of *Ælurognathus* (S.A. M. Cat. no. 2342), and, together with Watson's figure of *Scymnognathus*, will probably indicate the fundamental nature of the neck in all *Gorgonopsia*.

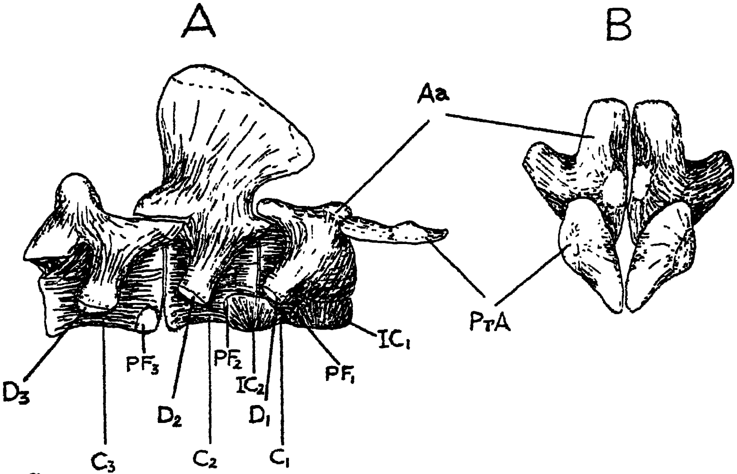
The material consists of an articulated series of seven vertebræ in articulation with the skull.

The neck is very firmly articulated to the skull. Six elements co-operate—centrally the centrum of the atlas (odontoid) is applied to the basioccipital, ventrally a strong atlantal intercentrum, closely applied to both the odontoid and the basioccipital, strengthens this joint; laterally the anterior portion of the atlantal arch meets the exoccipital and, dorsally, the paired proatlas rest on the supraoccipital.

Proatlas.—The proatlas consists of a pair of flattened rhomboidal plates overlying the dorsal surface of the spinal cord as it emerges from the foramen magnum. Their position is best understood by referring to the illustration (fig. B). On the dorso-lateral surface a thickening of the bone produces a low protuberance. Posteriorly the proatlas articulates with a prezygapophysial surface on the antero-dorsal surface of the atlantal arch.

Atlas.—The atlas consists of a pleurocentrum (odontoid), which in part carries a pair of unfused elements which constitute the neural arch. Unfortunately, very little can be seen of the pleurocentrum, as it is practically encircled by the neural arch and the atlantal and axial intercentra—the latter two elements producing very firm anterior and posterior articulations. Each element of the arch consists of an irregularly shaped bone, which is prolonged posteriorly to carry two facets; the dorsomedian prolongation carries a postzygapophysial facet which articulates with the prezygapophysis on the axis and the lateral prolongation (a diapophysis) carries a facet for the tuberculum of the dichocephalous atlantal rib. The antero-dorsal prezygapophysial facet for the proatlas has already been mentioned. The two elements of the arch, dorsally, just meet at the median line, and are here somewhat thickened to form a low protuberance which constitutes a rudimentary paired neural spine.

Atlantal Intercentrum.—The atlantal intercentrum forms a semicircular disc intercalated between the atlantal pleurocentrum and the occiput. It is a large element, and on its postero-lateral corner carries a facet for the capitulum of the atlantal rib. This facet is not carried by a distinct process as in *Seymouria.*



Cervicals of the type of *Ælurognathus tigriceps* (S.A. M. Cat. no. 2342), ×1/2. A. Lateral view of the right side of the anterior three cervicals; B. Dorsal view of the paired proatlas and the atlantal arch.

Aa, half of the paired atlantal arch; C_1, C_2, C_3, the first three pleurocentra; D_1, D_2, D_3, the first three diapophysial facets for the capitula of the dichocephalous ribs; IC_1, IC_2, the atlantal and axial intercentra, both carrying parapophysial facets; PF_1, PF_2, PF_3, the first three parapophysial facets for the tuberculum of the dichocephalous ribs; *PrA*, half of the paired proatlas.

Axis.—The axis is a typical reptilian holospondylous vertebra with the pleurocentrum and neurocentrum fused. The spine is elongated anteriorly so as to overhang the atlantal arch in the median line. The two pairs of zygapophyses are horizontal and well developed.

A strong and prominent diapophysis arises from the junction of the centrum and arch; it is directed posteriorly and carries a facet for the tuberculum of the dichocephalous axial rib. As in the case of the atlantal intercentrum it carries a facet for the capitulum of the axial rib. The axial intercentrum, is, however, smaller than that of the atlas.

Third Cervical.—The third cervical differs from the axis in that the neural spine is only developed as a low boss; the diapophysis is much longer; a low parapophysis is developed on the extreme antero-lateral edge of the centrum and gives articulation to the capitulum of the dichocephalous rib; no intercentrum is preserved, and it is doubtful whether one was present during life.

Fourth to Seventh Cervicals.—These four vertebræ are very similar—the main point of difference being the fact that in posterior direction the diapophyses progressively increase in length. They differ from the anterior ones in the shape of the neural spine, which is fairly low, antero-posteriorly elongated, and laterally compressed. There is no marked increase in width across the zygapophyses and the intercentra appear to be absent. The parapophyses situated on the antero-lateral edge of the centrum becomes progressively stronger, and in the seventh is situated further back on the centrum at some distance from the anterior edge.

A comparison with Watson's figure shows that the cervicals of these two Gorgonopsian genera agree on all essential points of structure, and it thus appears legitimate to assume that the description given here holds good in essentials for all members of the *Gorgonopsia.*

The chief measurements are :—

	mm.
Proatlas :	
Length	35
Width	17
Atlas :	
Total height	37
Length of arch	40
Oblique height of arch	39
Height of odontoid	23
Width of odontoid	31
Atlantal intercentrum :	
Length	20
Width	34
Atlas :	
Total height	76
Height of centrum	21

Atlas (*cont.*) :	mm.
Width of centrum	27
Length of centrum	32
Width across prezygapophyses	34
,, ,, postzygapophyses	39
,, ,, diapophyses	60
Height of spine	35
Length of spine	55
Width of spine	15

	3rd cervical.	5th cervical.
Total height	56	67
Height of centrum	25	26
Width of centrum	32	35
Length of centrum	33	36
Width across prezygapophyses	35	35
,, ,, postzygapophyses	41	37
,, ,, diapophyses	61	74

The main points of interest in these Gorgonopsian cervical vertebræ are :—

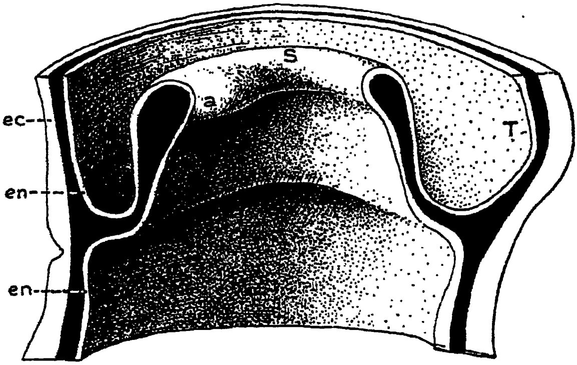
1. The retention, as in most reptiles, of many temnospondylous characters in the atlantal elements, viz., unfused intercentrum, pleurocentrum, and paired neural elements.
2. The non-development of an atlantal neural spine is a specialised character which it shares with all reptiles that have evolved beyond the primitive Seymourian condition.
3. The presence of dichocephalous ribs which in many other reptiles have been replaced by single-headed ribs.
4. The presence of a dichocephalous atlantal rib which is lost in most other reptiles.

VI.—*On the Tentacle Sphincter Muscle of* Boloceroides hermaphroditica (*Anthozoa*). By Frances M. Horton, Ph.D., Zoology Department, University of Birmingham.

The anemone *Boloceroides hermaphroditica* can detach itself from the substratum and swim freely through the water by means of its tentacles. These are flexed, drawn up into a vertical position, and then extended in a vigorous downstroke towards the base of the animal, which thus progresses, oral end first, through the water (Komori, 1931). An investigation has been made of individuals of this species, collected by Professor H. Munro Fox in the Suez Canal (Carlgren, 1924), in order to look for any outstanding features of the musculature which might be correlated with the unusual movements of which the animal is capable *.

The tentacle sphincter muscle was found to be remarkably strongly developed (fig. 1). It may best be described as a dome-like structure attached by its base to the lower part of the tentacle-wall. A circular area must, however, be imagined to be removed from the apex of the "dome," for there is a continuous passage from the cavity of the tentacle, through the centre of the sphincter, into the general body-space. Two distinct bulges occur opposite one another in this sphincter muscle (fig. 1, *a*).

Fig. 1.



Reconstruction from sections of half of the tentacle base of *Boloceroides hermaphroditica*.

a, region of thickening of sphincter; *ec*, ectoderm; *en*, endoderm; *S*, sphincter; *T*, tentacle-wall. Mesoglœa and muscle-fibres shown in black.

Bolocera tuediæ and *Bunodeopsis globulifera* both possess tentacle sphincters, but they have no faculty of swimming. The massive form of the sphincter in *Boloceroides hermaphroditica*, as compared with its lesser degree of development in these two forms, which show a similar plan of tentacle musculature, is shown by fig. 2.

It seems reasonable to suggest that the strong development of the sphincter in *Boloceroides hermaphroditica* has a relation to the swimming movements accomplished by the animal, though it is difficult to imagine a mechanism by which contraction of the circular muscle-fibres of the tentacle sphincter could produce a beating movement of the tentacle. The contraction of the longitudinal muscles on the aboral side of the tentacle, however, must almost certainly take part in the production of the movement, and whether or not the sphincter muscle-fibres play an integral part in the lashing of the tentacles, they will in any case help to strengthen the tentacle-bases, which must be regions of strain owing to their position at the junction of the body with the organs of propulsion.

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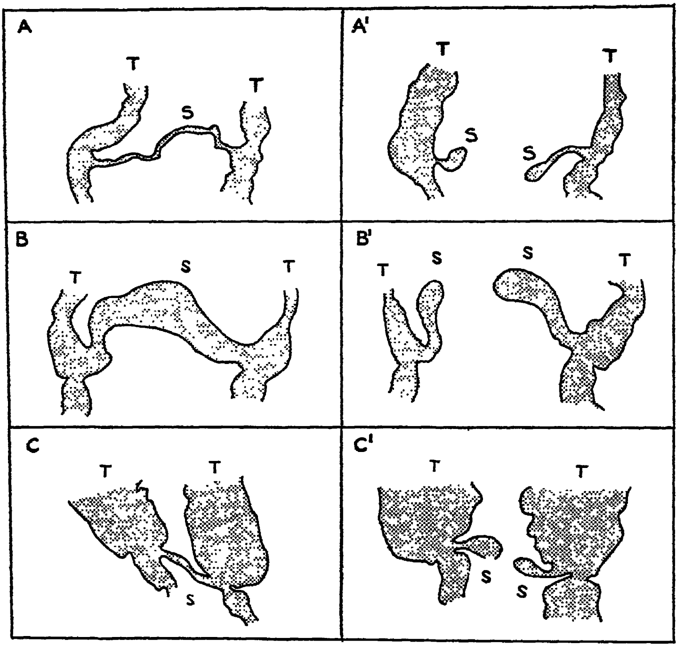
* I am indebted to the British Museum (Natural History) for the loan of two specimens of *Bunodeopsis globulifera* from Port Antonio, to Miss E. M. Stephenson for *Bolocera tuediæ*, and to Mr. H. G. Newth and Captain Totton for help.

Fig. 2.



Outlines of longitudinal sections through tentacle-bases of *A*, *A'*, *Bunodeopsis globulifera*; *B*, *B'*, *Boloceroides hermaphroditica*; *C*, *C'*, *Bolocera tuediæ*.

S, sphincter; *T*, tentacle-wall. On the right sections through the middle, on the left to one side of the middle, of the tentacle-base. Magnification the same in each case.

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Carlgren. 1924. Trans. Zool. Soc. Lond. vol. xxii.
Komori. 1931. Mem. Coll. Sci. Kyoto Imp. Univ. ser. B, vol. vii.

VII.—*Revision of the Madagascar Timaliine Birds.*

By FINN SALOMONSEN (Copenhagen).

THE Timaliine section of the great family Sylviidæ (or Muscicapidæ) is in Madagascar represented by a little group of birds very like each other in coloration, but having a remarkable variation in the structure of wing, tail, bill, and feet. Although these birds form a natural group, in which several species bridge the differences between the most specialized forms, they have been split up into so many genera that there is almost a generic name available for each species. However, it must be admitted that these birds are difficult to arrange, as the structural differences between many of the species put in the same genus are as important as those between other genera maintained in the Sylviidæ. The colour-pattern shows no special variation, especially when comparing it with the strong structural differentiation in this group, and all species (except *Oxylabes madagascariensis* and *Mystacornis crossleyi*) are, roughly speaking, greenish above, yellowish below. Of the five genera recognized here three are monotypical (*Mystacornis*, *Bernieria*, and *Hartertula*), and of the two others *Neomixis* is a very well-defined genus. The members of the genus *Oxylabes*, however, are all more or less different in structure, and it would not be very difficult to split them up into further genera, as has already been done. The main differences are to be found in the structure and shape of the bill and tail. As a matter of fact, considerable differences exist in many other groups of Sylviidæ regarding these two characteristics. Concerning difference in shape of tail, I will call attention, for instance, to *Sylvia* *, *Apalis* †, *Cisticola* ‡, *Calamo-*

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* In certain species, for instance the *Melizophilus undatus* of some authors, the tail exceeds length of wing by more than length of tarsus, and the tail is strongly graduated, the difference between the outermost lateral and the median rectrices being nearly as large as length of tarsus, whereas in other species, for instance *S. curruca*, *borin*, &c., the tail is much shorter than wing and only slightly rounded, nearly square.

† In some species, e. g., *A. flavida*, the tail is shorter than the wing by the length of tarsus, and the graduation (*i. e.*, the difference in length between the outermost lateral and median rectrices) is the same as the length of tarsus. In other species (e. g., *A. jacksoni*) the tail is much longer than wing and the graduation nearly three times length of tarsus.

‡ In *C. juncidis* and its races the tail is longer than three-quarters of the wing, in *C. textrix* and in other species it is much shorter, hardly exceeding half the length of wing.

cichla *, *Camaroptera* †, and many other genera. Regarding the differences in shape of bill I shall mention *Macrosphenus* ‡, *Eremomela* § among others. Some genera of Sylviidæ are very varied in regard to the structural proportions of the members. In the oceanic genus *Bebrornis* strong differences are to be found between the two species *B. seychellensis* and *B. rodericanus* in shape of bill, wing-formulæ, and length of tail. In the African genus *Bradypterus* a great variability exists regarding structure and proportions; for instance, the differences between *B. sylvaticus* (short tail, pointed wing) and *B. victorini* (long tail, rounded wing) concerning not only wing and tail but also shape of bill and development of under tail-coverts are so considerable that Hartlaub separated the latter as *Phlexis* ||. Other species of *Bradypterus* differ remarkably by possessing only ten rectrices (*e.g.*, the dark *B. camerunensis* ¶), a fact which in other places suffices for generic division in some cases (*Prinia, Malurus, Amytornis, Scotocerca, Cettia*, &c.). In the genus *Cossypha* the variation in length and graduation of the tail is so marked that Sharpe placed the long-tailed *C. albicapilla* in the genus *Kittacincla* **.

These examples may suffice to show the great variations in the genera of Sylviidæ, and they also show the difficulties attached to the arrangement of the numerous Sylviine birds in natural groups. It cannot be expected that genera should always be groups of homogeneous species: they are to be regarded as only practical divisions, and their use seldom logical or objective; however, it is better not to split up into too many

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* The Madagascar reed-warbler, *Calamocichla newtoni*, has a slightly longer and more graduated tail than the African species, which by some authors—with only little reason—are separated as *Calamornis* (*cf.* the discussion about this name and the generic term *Hemiellesia* by Sclater, Bull. B. O. Club, 1927, p. 118, and Neumann, Novit. Zool. vol. xv. 1908, p. 245).

† *Camaroptera brachyura* has a much shorter tail than *C. superciliaris* and *C. griseoviridis*.

‡ *Macrosphenus concolor* has a much shorter bill than *M. kempi* and *M. flavicans*, and was therefore first described as a *Camaroptera*.

§ Some species (for instance, *Eremomela usticollis*) have a much finer and more pointed bill than others (for instance, *E. pusilla* &c.).

|| 'The Ibis,' 1866, p. 139. *Phlexis*, however, as pointed out by Oberholser (Proc. Phil. Acad. 1899, p. 212), is preoccupied, and Oberholser proposes *Cryptillas* as a substitute.

¶ *Cf.* Bannerman, 'Ibis,' 1915, p. 501.

** Cat. Birds Brit. Museum, vol. vii. p. 89.

groups, as this makes the utility of the genera illusory. It is necessary and useful to separate a species generically only if one or more important characters which are constant in its nearest allies have here changed. Therefore I agree with Stresemann in separating *Neomixis flavoviridis* Hart. as *Hartertula*, as the shape of its tail is quite different from that of all other members of the group *Neomixis*, and, to give a better example, I think it is right to separate *Anas clypeata* (and its subspecies *capensis*, *rhynchotis*, and *platalea*) as *Spatula*, as its peculiar bill places it far from the other surface-feeding ducks.

I recognize the following genera and species of the Madagascar Timaliinæ :—

NEOMIXIS Sharpe, 1881.

Neomixis Sharpe, Proc. Zool. Soc. London, 1881, p. 195. Type by original designation, *Neomixis striatigula* Sharpe.

Eroessa Hartlaub, Proc. Zool. Soc. London, 1866, p. 218. Type by monotypy, *Eroessa tenella* Hartlaub. (Preoccupied; *cfr.* Oberholser, Proc. Phil. Acad. 1899, p. 211.)

Diagnosis.—Bill shorter than tarsus, thin and pointed and slightly arched, upper mandible considerably curved (*cf.* fig. B, p. 74); rictal bristles absent; wing rather pointed; tail slightly rounded, shorter than wing; legs and feet weak. Coloration lipochromatic. Sexes alike.

Characteristics.—Small warbler-like birds with wing seldom exceeding 50 mm. Bill very short and fine, shorter than tarsus, about length of middle toe, pointed and tapering, slightly curved; the upper mandible considerably bent. Rictal bristles absent. Wing rather pointed; first primary less than half the length of second primary; second primary about the same length as first secondary; fourth, fifth, and sixth primaries of equal length and the longest, the third only slightly shorter. Tail short, about four-fifths the length of wing, being shorter than wing by nearly length of middle toe; slightly rounded. Feet and legs weak, middle toe not exceeding 25 per cent. of wing-length. Coloration lipochromatic, *i. e.*, rich in lipochromes, the plumage being greenish on the upper parts, yellowish on the underparts. Male and female indistinguishable.

Neomixis tenella.

Hab. The entire Madagascar, except the central high plateau.

Neomixis tenella tenella (Hartl.).

Eroessa tenella Hartl. Proc. Zool. Soc. London, 1866, p. 218 (N.E. Madagascar).
Eroessa tenella typica M.-Edw. & Grandid. Hist. Phys. &c. de Madag. vol. xii. 1881, p. 321.

Hab. The northern parts of Madagascar, to the south to Maroantsetra (in the east) and Maintirano (in the west).

Neomixis tenella orientalis Del.

Neomixis tenella orientalis Delacour, 'l'Oiseau,' 1931, p. 482 (Fanovana).

Hab. Eastern Madagascar, south of the breeding area of *N. t. tenella.*

Neomixis tenella decaryi Del.

Neomixis tenella decaryi Delacour, 'l'Oiseau,' 1931, p. 482 (type-locality restricted here to Tsiandro).

Hab. The central parts of Western Madagascar, between Maintirano and Lake Iotry.

Neomixis tenella debilis Del.

Neomixis tenella debilis Delacour, 'l'Oiseau,' 1931, p. 482 (Tabiky).

Hab. The south-western parts of Madagascar, south of Lake Iotry.

Neomixis viridis.

Hab. Eastern Madagascar, from Andapa in the north to Ivohibe in the south.

Neomixis viridis viridis (Sharpe).

Eroessa viridis Sharpe, Cat. Birds Brit. Mus. vol. vii. 1883, p. 152 (Ankafana forest). Type examined.

Hab. Eastern slopes of the high plateau in south-east Madagascar (from Fianarantsoa to Ivohibe) at about 3000–5000 feet altitude, but apparently not frequenting the coastal lowlands.

Neomixis viridis delacouri, subsp. n.

Type in the British Museum, ♂ ad., coll. the Franco-Anglo-American Expedition, Maroantsetra, north-eastern Madagascar, 23. vi. 1930, no. 6354.

Description.—Differing from *N. v. viridis* in being darker. The upper parts are grass-green, in *viridis* greyish green; the underparts are darker yellowish and provided with rather heavy blotchings and streakings of grey, whereas *viridis* is unspotted below or in some specimens finely streaked greyish.

Hab. The slopes of the eastern mountains from Fanovana in the central parts of the east coast to Andapa in the north, occurring only in the forests at about 3000–5000 feet altitude, avoiding the coastal lowlands as well as the higher elevations.

Material.—*N. v. viridis*: 9 specimens; 6 from Fianarantsoa and Ankafana (type and co-types, coll. Cowan, March, May), 3 Ivohibe (August, September), all specimens alike. *N. v. delacouri*: 9 specimens; 1 Sianaka, 3 Fanovana (May), 3 Maroantsetra (June, July), 2 Andapa (August, September), all specimens alike.

Remarks.—I name this conspicuous form after my friend J. Delacour, whose important paper on the genus *Neomixis* ('l'Oiseau,' 1931, p. 480) was a great advance in our knowledge of these puzzling birds.

Neomixis striatigula.

Hab. The south-west and the mountain-forests of the east.

Neomixis striatigula striatigula Sharpe.

Neomixis striatigula Sharpe, Proc. Zool. Soc. London, 1881, p. 195 (Fianarantsoa, Eastern Madagascar). Type+co-type examined.
Eroessa tenella var. *major* M.-Edw. & Grandid. Hist. Phys. &c. de Madag. vol. xii. 1881, p. 323. (No type-locality.)

Hab. The eastern slopes of the high plateau in south-eastern Madagascar (Fianarantsoa, Ankafana).

Neomixis striatigula sclateri Del.

Neomixis striatigula sclateri Delacour, 'l'Oiseau,' 1931, p. 480 (Fanovana).

Hab. The slopes of the eastern mountains from Fanovana to Andapa in the northern parts of the island. It seems to be rare, as only few specimens are known.

Remarks.—*N. striatigula* is apparently confined to the same stretches in the east as *N. viridis*, neither of them are found in the coastal lowlands (Vondrozo, Manombo, Tamatave, Antalaha, &c.), where only *N. tenella* occurs.

This last species, however, has a wider distribution than the two others, and is found together with these on the slopes of the mountains. All three species have paler subspecies in the south-east. Whereas *N. viridis* is confined to the east, *N. striatigula striatigula* occupies also the southern parts of the interior high plateau, where it was found and captured at Ihosy (*cf.* Delacour, 'l'Oiseau,' 1931, p. 480, and 1932, p. 64). Farther west it is replaced by

Neomixis striatigula pallidior, subsp. n.

Type in the British Museum, ♂ ad., coll. the Franco-Anglo-American Expedition, Ampotaka, 20 March, 1930, no. 3546.

Description.—Paler above and below than *N. s. striatigula.* The upper parts are greyish green, in *striatigula* olive-green, the underparts are paler yellow. (*N. s. sclateri* is darker than *striatigula*, having the upper parts dark green, the underparts vivid yellow with heavier streakings.)

Measurements.—*N. s. pallidior* is on an average smaller than *striatigula.* Wing: *striatigula* 51–54, *pallidior* 48–52 mm. Bill: *striatigula* 16–17, *pallidior* 14–16 mm.

Hab. The arid plains of South-west Madagascar (Lake Iotry, Lake Tsimanampetsotsa, Tabiky, Befandriano, Ampotaka).

Material.—*N. s. striatigula*: 2 specimens from Fianarantsoa (type and cotype; coll. Cowan; March). *N. s. pallidior*: 9 specimens from the localities mentioned above; of these 3 are from the type-locality(Ampotaka), collected in the same month as the types of *N. s. striatigula*, being fresh moulted.

Remarks.—The name *major*, by M.-Edwards and Grandidier (*vide antea*), cannot be used for this form, as the authors do not give any localities for their bird, but only mention the place Fianarantsoa for Sharpe's type-specimens; furthermore, the description fits better to the dark *striatigula* * than to the pale form *pallidior*. Delacour (*l. c.* 1931, p. 480) had already noticed that the south-western specimens were paler, but without naming them.

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* The bird is figured on pl. cxiii. and is darker than *tenella* on the same plate, and this is the case only with *striatigula*.

HARTERTULA Stresemann, 1925.

Hartertula Stresemann, Ornith. Monatsber. vol. xxxiii. 1925, p. 186. Type by original designation, *Neomixis flavoviridis* Hartert.

Diagnosis.—Very near to *Neomixis*, but differing in having strongly graduated tail, longer than wing, and wing more rounded.

Characteristics.—Bigger than the *Neomixis* forms, with wing measuring more than 50 mm. Bill shorter than tarsus, about the length of middle toe, pointed and slightly curved as in *Neomixis*, but somewhat stouter than in this genus; the upper mandible curved downwards. Rictal bristles absent. Wing rounded; first primary longer than half the length of second; second primary shorter than first secondaries; fifth and sixth primaries of equal length and the longest, the third much shorter, not exceeding the eighth primary in length, the fourth slightly shorter than the fifth. Tail longer than wing, strongly graduated; the distance between the shortest and longest rectrices (r_6—r_1) about half the length of tail or nearly twice the length of middle toe. Feet and legs weak, middle toe not exceeding 25 per cent. of wing-length. Coloration lipochromatic, sexes indistinguishable.

Hartertula flavoviridis.

Neomixis flavoviridis Hartert, Bull. Brit. Ornith. Club, vol. xlv. 1924, p. 35 (Anamalazastra, Madagascar).

Hab. The coastal lowlands of east and south-east Madagascar, from Vondrozo to Sianaka.

OXYLABES Sharpe, 1870.

Oxylabes Sharpe, Proc. Zool. Soc. London, 1870, p. 386. Type by monotypy, *Motacilla madagascariensis* Gm.

Crossleyia Hartlaub, Die Vögel Madagascars, 1877, p. 168. Type by monotypy, *Oxylabes xanthophrys* Sharpe.

Xanthomixis Sharpe, Proc. Zool. Soc. London, 1881, p. 196. Type by monotypy, *Bernieria zosterops* Sharpe.

Nesobates Sharpe, Bull. Brit. Ornith. Club, vol. xii. 1902, p. 54. New name for *Oxylabes* Sharpe.

Xanthomiscus Sclater, Syst. Av. Ethiop. vol. ii. 1930, p. 368 (*errore*).

Diagnosis.—Differing from *Neomixis* and *Hartertula* in the shape of the bill, which is thick and strong and blunt and never pointed, but provided with a more or less conspicuous hook, and is straight, not slightly curved.

Rictal bristles present. Feet and legs stronger. Wing rounded, as in *Hartertula*.

Characteristics.—This is a very heterogeneous group, all species differing more or less from each other in the structure. Rather big babbler-like birds, with wing longer than 65 mm. Bill much shorter than tarsus, and even shorter than middle toe in all except *zosterops*, in which it is equal to middle toe or slightly longer. Furthermore, the bill is blunt and thick, hooked and straight, not curved, the upper mandible slightly bent. The bill is weak and hook nearly absent in *xanthophrys*, hook well defined in *cinereiceps* and *tenebrosa*, bill stronger and hook still longer in *zosterops*, thickest and strongest bill in *madagascariensis*. Rictal bristles present, short and reaching only to posterior border of nostrils in *xanthophrys* and *tenebrosa*, passing the anterior border of the nostrils in *cinereiceps* and *madagascariensis*, and nearly reaching tip of bill and being especially numerous in *zosterops*. Wing-formulæ as in *Hartertula*, the first primary being even longer, often about two-thirds of the length of second primary. Tail slightly rounded in all except *xanthophrys* and *madagascariensis*, having graduated tail. In *O. xanthophrys* the distance between the shortest and longest rectrices is about one-third of length of tail or about the length of middle toe, in *O. madagascariensis* somewhat shorter. Tail a trifle shorter than wing (shortest in *tenebrosa* and *cinereiceps*), but never shorter than wing by length of middle toe ; in *xanthophrys* and in *madagascariensis* wing and tail are equal, or the tail even exceeds wing slightly. Feet and legs strong in most species, the length of middle toe being 30–35 per cent. of length of wing, except *cinereiceps* and *zosterops*, in which it constitutes only 24–28 per cent., being shortest in *zosterops*. In addition, differences exist in the shape of nostrils (slit-formed or oval) and in the scutellation of the tarsus, but the differences are certainly too small to be of any taxonomic value. Coloration lipochromatic (except in *O. madagascariensis*, in which throat is white, contrasting with chestnut underparts and crown). Sexes indistinguishable.

Remarks.—The great variation in the structural characteristics of the genus *Oxylabes*, as described above (no two species being similar), shows sufficiently that a further generic division is impossible, or, at any rate, very difficult, unless all species are put in different genera.

Oxylabes xanthophrys.

Oxylabes xanthophrys Sharpe, Proc. Zool. Soc. London, 1875, p. 76 (Eastern Madagascar).

Hab. Eastern and South-eastern Madagascar, from Betsileo and Fianarantsoa to Sianaka.

Oxylabes cinereiceps.

Oxylabes cinereiceps Sharpe, Proc. Zool. Soc. London, 1881, p. 197 (Fianarantsoa, Eastern Madagascar).

Hab. Eastern and south-eastern Madagascar, from Fianarantsoa to Sianaka.

Oxylabes madagascariensis.

Motacilla madagascariensis Gmelin, Syst. Nat. ed. xiii. pt. 2, p. 952, 1789 (Madagascar, restricted here to East Madagascar).

Hab. Throughout eastern Madagascar, so far as from Manombo in south-east to the northernmost part of the island, and even recorded from the north-west (Maromandia).

Oxylabes tenebrosa.

Bernieria tenebrosa Stresemann, Ornith. Monatsber. vol. xxxiii. 1925, p. 150 (Sianaka, East Madagascar).

Hab. Confined to the Sianaka forest, eastern Madagascar.

Oxylabes zosterops.

Hab. Throughout eastern Madagascar, from Manombo in the south to the northernmost parts of the island, but very local and apparently restricted to the densely forested districts.

Remarks.—Whereas the other species of *Oxylabes* do not differ throughout their entire breeding area, *O. zosterops* is very variable, probably on account of its discontinuous distribution.

Oxylabes zosterops fulvescens (Del.).

Bernieria zosterops fulvescens Delacour, 'l'Oiseau,' 1931, p. 483 (Ambre Mts., North Madagascar).

Description.—The palest form, very poor in lipochromes, being greyish green above and pale cream-coloured suffused with buff below.

Material.—8 specimens (3 ♂♂, 5 ♀♀).

Hab. Confined to Ambre Mountain, in the northernmost Madagascar.

Oxylabes zosterops andapæ, subsp. n.

Type in the British Museum, ♂ ad., coll. the Franco-Anglo-American Expedition; Andapa, North-east Madagascar, 22. viii. 1930, no. 7387.

Description.—Supplied with more lipochrome than *fulvescens*, being darker green above and lemon-yellow below.

Material.—6 specimens (4 ♂♂, 2 ♀♀).

Hab. Confined to Andapa in North-east Madagascar.

Oxylabes zosterops maroantsetræ, subsp. n.

Type in the British Museum, ♂ ad., coll. the Franco-Anglo-American Expedition; Maroantsetra, North-east Madagascar, 15. vii. 1930, no. 6783.

Description.—This is the form richest in eumelanine, having the upper parts dark green and the flanks and breast dark olive-green; it is richer in lipochromes than *andapæ*, being darker yellow on the underparts.

Material.—19 specimens (9 ♂♂, 8 ♀♀, 2 oo).

Hab. Confined to Maroantsetra in North-east Madagascar, on the coast between Sambava and Fenerive, and quite isolated from the breeding area of *andapæ* and *zosterops*.

Oxylabes zosterops zosterops (Sharpe).

Bernieria zosterops **Sharpe, Proc. Zool. Soc. London, 1875, p. 76 (south of Tananarive, Eastern Madagascar). Type examined.**

Description.—This is the form richest in lipochrome, the underparts vivid sulphur-yellow, bright and shining. The eumelanotic pigmentation of flanks and breast not so pronounced, these parts being not so heavily marked as in *maroantsetræ*.

Material.—18 specimens (6 ♂♂, 8 ♀♀, 4 oo).

Hab. This form has the most extensive breeding area of the subspecies of *zosterops*, breeding in the great forest districts of the central parts of the east coast, from Sianaka to Manombo, occurring in the coastal districts, and being darkest in Sianaka and Fanovana, whereas in the south it merges with the next form.

Oxylabes zosterops ankafanæ, subsp. n.

Type in the British Museum, ♂ ad., coll. Cowan, Ankafana Forest at Fianarantsoa, Eastern Madagascar, February 1881, reg. no. 1882.2.27.59.

Description.—Less lipochromes than in *zosterops*, the yellow colour on the underparts being similar to that in *maroantsetræ* (thus paler than in *zosterops*), but strongly differing by the almost or entire absence of melanine pigments on the underparts, these being uniform yellow, with only faint indications of pale greenish olive on the lower flanks, and even these are yellow in some few specimens.

Material.—10 specimens (5 ♂♂, 5 ♀♀).

Hab. The forest (Ankafana) at Fianarantsoa in South-east Madagascar.

Remarks.—According to Sharpe the type of *O. z. zosterops* came from the country between Moroundava (now Morondava) and Antananarivo (now Tananarive), and must thus have been captured somewhere between the breeding area of the true pale *ankafanæ* and the dark *zosterops* (from Fanovana). The type and a co-type agree with this suggestion, as they are intermediate between *ankafanæ* and Fanovana specimens, but nearest to the last, however, and I therefore unite the dark yellow populations of Sianaka, Fanovana, etc., under the name *zosterops*, as the type comes nearest to these birds. Specimens from the southernmost east (Vondrozo, Manombo) and a single specimen from Iampasika are on an average paler yellow than *zosterops*, and may be designated as *zosterops*$\gtrsim$*ankafanæ*, although they are as rich in eumelanine as *zosterops*, and it is very likely that the true *ankafanæ* is restricted to Fianarantsoa.

I do not agree with Delacour in his treatment of these birds ('l'Oiseau,' 1931, p. 483). He calls *O. z. andapæ*: *fulvescens*>*zosterops*, *O. z. maroantsetræ*: *fulvescens*<*zosterops*, although he admits himself that the characters of these populations are very constant. The differences between these forms are as big as between *Bernieria m. madagascariensis* and *B. m. inceleber*; but even if he will not name them Delacour is not right in calling *maroantsetræ* intermediate between *andapæ* and *zosterops*, as this only holds good for its yellow (lipochromatic) colour, whereas its eumelanine is more developed and darker, as in both the other forms. As a matter of fact, we find in *O. zosterops* an example of a very remarkable local variation; all forms mentioned above are well defined, without any intergradations, forming distinct subspecies. Delacour calls also the population in south-east (Vondrozo, Manombo, Ivohibe) *fulvescens*<*zosterops*—the same designation as for *maroantsetræ*—in spite of this last being darker eumelanotic above and below and in spite of the breeding area of *fulvescens* lying far away in the north. The form from Fianarantsoa (*ankafanæ*) is not mentioned by Delacour.

BERNIERIA Bonaparte, 1854.

Bernieria Bonaparte, Compte Rend. vol. xxxviii. p. 11, 1854. Type by original designation, *Bernieria major* and *B. minor*=*Muscicapa madagascariensis* Gm.

Diagnosis.—Like *Oxylabes*, but bill in male much longer than tarsus (in female about the same length as tarsus), the upper mandible straight, not slightly curved, the hook very pronounced and nearly vertically bent downwards. Sexes strongly differing in size.

Characteristics.—Medium-sized babbler- or bulbul-like birds with wing exceeding 65 mm. Bill much longer than tarsus in male, equal to tarsus but exceeding length of middle toe in female. Bill in male straight, without any curvature of upper mandible, provided with a strong hook, bent nearly vertically downwards. Bill in female as in *Oxylabes zosterops*. Rictal bristles present, passing the anterior border of nostrils. Wing-formulæ as in *Oxylabes*. Tail rounded, slightly shorter than wing. Feet and legs weak, middle toe being about 25 per cent. of length of wing. Coloration lipochromatic, sexes alike in coloration, but female much smaller and with much shorter bill than male *; therefore regarded as two species (*major* and *minor*) by Bonaparte.

Bernieria madagascariensis.

Hab. The whole of Madagascar except the extreme south and the central mountains.

Bernieria madagascariensis madagascariensis (Gm.).

Muscicapa madagascariensis Gmelin, Syst. Nat. ed. xiii. 1789, p. 940 (Madagascar; restricted to East Madagascar).
Bernieria major and *B. minor* Bonaparte, *l. c.*

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* Wing: ♂♂ 82–86, ♀♀ 69–72 mm. Bill: ♂♂ 28–29, ♀♀ 21–23 mm.

Hab. The entire east, in the north merging into the next subspecies.

Bernieria madagascariensis inceleber Bangs & Peters.

Bernieria madagascariensis inceleber Bangs & Peters, Proc. New Engl. Zool. Club, vol. ix. 1926, p. 43 (Siribihina, Western Madagascar).

Hab. The entire west, except the extreme south. One record—probably of this race—from Moheli, Comoro Islands *.

MYSTACORNIS Sharpe, 1870.

Mystacornis Sharpe, Proc. Zool. Soc. London, 1870, p. 392. Type by original designation, *Bernieria crossleyi* Grand.

Diagnosis.—Like *Oxylabes*, but rictal bristles entirely absent; culmen straight; length of bill exceeding middle toe; tail very short, shorter than wing by length of middle toe. Coloration not lipochromatic, sexes dissimilar.

Characteristics.—This is the most specialized genus. Rather big babbler-like birds, with wing exceeding 70 mm. Bill a trifle shorter than tarsus, but longer than middle toe; culmen straight, as in *Bernieria*, but hook ill-defined, very short, or nearly absent. Rictal bristles absent. Wing-formulæ as in *Oxylabes* and *Bernieria*. Tail rounded, about two-thirds of length of wing, or shorter than wing by length of middle toe. Legs and feet weak, the middle toe constituting only 25 per cent. of length of wing. Coloration not lipochromatic, the plumage provided with large amount of black eumelanine, pattern of head grey-white-black. Sexes easily distinguished.

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* This record is the only one known from the Comoro Islands, and this species has never been found since Kirk, about 70 years ago, secured the Moheli specimen, not even on Mayotte, which is situated nearest to Madagascar and is best known. The history of Kirk's specimen is somewhat mysterious. It is mentioned by Dr. P. Sclater, who worked out Kirk's small collection ('Ibis,' 1864, p. 297), and is said to have been "shot in the same place as the *Hypsipetes*." This *Hypsipetes* is in the British Museum, but the *Bernieria* is not. Kirk's collection went to Jardine's Museum and later to the British Museum (*cf.* Hist. Coll. Nat. Hist. Dept. Brit. Mus. vol. ii., Birds, p. 407), but the *Bernieria* was never received here. However, the Comoro record is mentioned in the entire literature: Hartlaub, Vögel Mad. 1877, p. 146; M.-Edw. & Grandid. Hist. Phys. &c. vol. xii. p. 351; Pollen & v. Dam, Rech. Faune Mad. vol. ii. p. 90; M.-Edw. & Oust., Nouv. Arch. (2) vol. x. 1885, p. 285.

Mystacornis crossleyi.

Bernieria crossleyi Grandidier, Rev. et Mag. Zool. 1870, p. 80 (Lake Alaotra, Eastern Madagascar).

Hab. The whole of eastern Madagascar, recorded as far north as Andapa.

The following table, giving the most important measurements of the birds mentioned above, shows the structural differences between the species in this group. Of the species of *Neomixis* only *N. tenella* is shown here, as all members of this genus are structurally identical:—

	Neomixis tenella.	*Hartertula flavoviridis.*	*Oxylabes xanthophrys.*	*Oxylabes cinereiceps.*	*Oxylabes madagascariensis.*	*Oxylabes tenebrosa.*	*Oxylabes zosterops.*	*Bernieria madagascariensis.*		*Mystacornis crossleyi.*
								♂.	♀.	
Wing......	45–47	55–57	65–69	64–81	65–71	65–73	66–73	82–86	69–72	71–76
Bill	12–13	13–14	13–15	16–17	18–20	17–18	18–19	28–29	21–23	22–24
Tail	37–39	58–60	65–73	60–73	65–72	55–58	64–71	78–80	66–70	50–57
Graduation*	2–5	23–26	18–30	6–10	14–17	6–7	8–9	9–11	8–10	8–10
Tarsus.....	15–16	16–18	25–28	21–23	22–26	25–26	21–23	22–25	21–22	24–25
Middle toe..	12–12	14–14	19–20	18–21	22–23	23–23	16–18	20–22	17–18	19–20

The Timaliine birds, described above, are confined to Madagascar proper, and, with the exception of the single specimen of *Bernieria madagascariensis inceleber* captured at Moheli, they are never met with outside Madagascar. The centre of distribution is the densely forested eastern country, especially the forest Sianaka, north of Tananarive, in which all eleven species recognized here are to be found. On the other side, no species is peculiar to the west, but three species (viz., *Neomixis tenella*, *N. striatigula*, and *Bernieria madagascariensis*) have extended their breeding area over the western Madagascar, *Neomixis striatigula*, however, only over the southern parts of the west. Regarding the twenty-two subspecies recognized, eighteen are peculiar to the east, but only four to the west.

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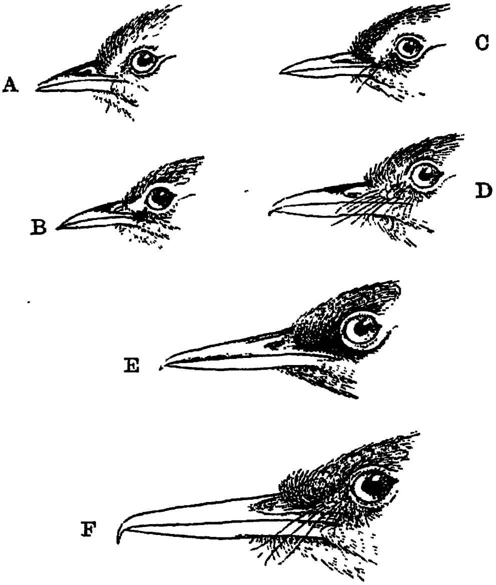
* The difference in length between the longest and shortest tail feather.

The Madagascar members of the Timaliidæ form a good and natural group (and might perhaps be called a subfamily), all being very nearly allied to each other. The species of *Neomixis*, of which *N. striatigula* has the longest and strongest bill, are naturally connected with *Oxylabes* through *Hartertula*; this is intermediate in size and has the bill of the pointed *Neomixis* type, but almost as strong as in *Oxylabes xanthophrys* and



A. *Hartertula flavoviridis*.
B. *Neomixis tenella*.
C. *Oxylabes xanthophrys*.
D. *Oxylabes madagascariensis*.
E. *Mystacornis crossleyi*.
F. *Bernieria madagascariensis*.

cinereiceps (*cf.* fig.). The wing-formula in *Hartertula* also is intermediate between the two genera mentioned. *Oxylabes xanthophrys* and *cinereiceps*—especially the first—form the transition between *Hartertula* and the other still stronger billed *Oxylabes* * forms, to which *Bernieria* and *Mystacornis* are also attached. Whereas *Bernieria* obviously has developed from forms nearly allied to *O. zosterops*, *Mystacornis* is more specialized, but seems to be nearest to *O. madagascariensis*. According to my opinion the structurally very variable group *Oxylabes*, showing many primitive characters, such as rounded wing, strong bristles, &c., is the most primitive one, from which all the others have developed, the most " modern " forms being the *Neomixis*, which are nearly *Sylvia*-like, with comparatively pointed wing, small proportions, absence of bristles, thin bill, &c., with many similar species, divided into many subspecies and with a wide distribution; probably they are still in evolution. I suggest the connection between the species shown on p. 76.

The fully drawn lines show the evolution of the species or genus from the beginning of its differentiation from the common ancestor; the longer the line is the more specialized or developed the species is, the shorter the more primitive. The dotted lines show the affinity between the different forms, as is suggested on account of their structural and colouristic similarities or dissimilarities.

Although these birds without any doubt belong to each other, forming a special Madagascar group (subfamily ?), their close relationship has not before been discovered, and they have been placed far from each other in the system—have even been put into different families. Only Sharpe † saw their near affinity, and classified them all in his family Timaliidæ, divided into six genera—*Neomixis*, *Bernieria*, *Mystacornis*, *Xanthomixis*, *Crossleyia*, *Oxylabes* (*Hartertula* was not known at that time). However, in his 'Catalogue of Birds' ‡ it is hardly possible to find any system in his arrangement of these birds:

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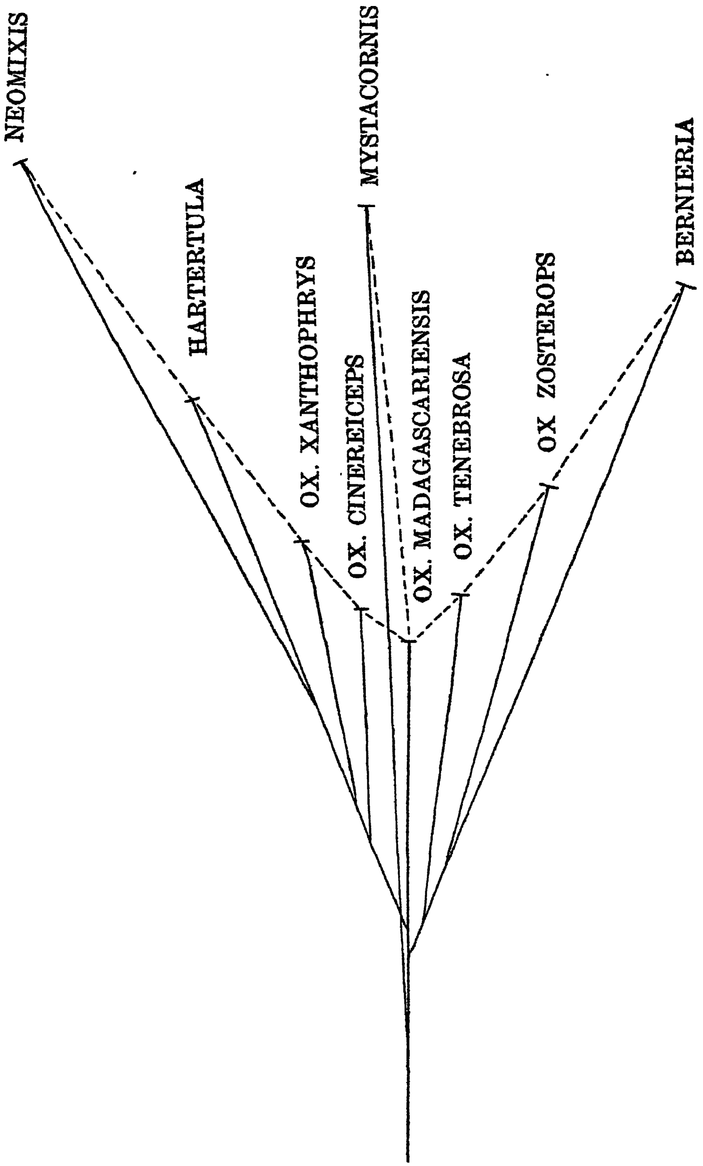
* Not only the weak bill, nearly without hook in *O. xanthophrys*, but also its few reduced bristles and its long tail show its affinity to *Hartertula*.

† Proc. Zool. Soc. London, 1881, p. 196.

‡ Cat. Birds Brit. Museum, vol. vii.



Evolution and affinities of Madagascar Timaliine birds.

Xanthomixis and *Oxylabes* are placed beside *Malacopteron*, *Tatare* (=*Conopoderas*) comes between *Crossleyia* and *Bernieria*, and *Mystacornis* is placed between *Macrosphenus* and *Stachyris*. Also to other ornithologists this group has been a puzzle. Sclater *, and following him Delacour †, placed *Neomixis* and *Hartertula* in the Sylviidæ, *Oxylabes*, *Bernieria*, and *Mystacornis* in the Timaliidæ. Milne-Edwards and Grandidier ‡ did the same, but even split the group up further, creating a family Phyllastrephidæ for *Phyllastrephus* and *Bernieria* (including *Oxylabes zosterops*). I suppose Milne-Edwards' Phyllastrephidæ might be included in the family Pycnonotidæ of other ornithologists. On account of its bill and comparatively small feet *Bernieria madagascariensis* has been called a Pycnonotid also by other students, as Hartlaub § and Chapin ‖; by others it has been called *Macrosphenus* ¶, and it has even been put in the Sylviine genus *Tatare* **. It must be admitted that the family Pycnonotidæ is extremely ill-defined, the members of it being very nearly allied to the so-called Timaliidæ, but as a rule the feet are very short, the middle toe forming less than 20 per cent. of length of wing and the tarsus being still shorter, whereas in the Timaliidæ the tarsus is always longer than middle toe (*cf.* table above ††). Other students compared these birds with very different genera; so Hartlaub has compared *Oxylabes* with *Napotheres* (=*Malacopteron*), and *Mystacornis* with *Drymocataphus* ‡‡; in another paper by Hartlaub *Neomixis* is compared with *Camaroptera* §§, whereas M.-Edwards and Grandidier compare it with *Dryodromas* (=*Apalis*) and *Eremomela*, &c. ‖‖.

My opinion regarding the classification of these birds is as follows:—The so-called Timaliidæ, which are primitive tropical Sylviidæ, are spread over the Ethiopian, the Lemurian, and the Indian region (only partly in the Australian). Isolated in these regions they have developed many species and genera, most of which are peculiar to their respective region, and very few genera being found in two regions. *Pomatorhinus* * is common to the Indian and Australian region only, *Alcippe* †, *Turdinus*, and *Argya* to the Indian and African only, whereas all Lemurian genera of this family are peculiar to Madagascar. All these birds, however, are so nearly allied that many species or genera, developed on different places, look very like each other, although they have evolved quite independently. This only shows their near affinity. I may say that when a group of organisms is so equal that it is practically impossible to subdivide it, on account of the similarity of the members, most differences between the subgroups being bridged over or approached by some species, it certainly should be united in one genus. We would thus have to put the greater part of the Timaliidæ—at least several hundred forms—into one genus, which would be impossible according to the present rules. However, although the birds developed in the four main centres are so nearly allied that their characteristics often approach each other, they show in Madagascar—and probably also other places—the closest resemblance *inter se*, forming a special group in which the differences between the most specialized forms are gradually bridged by others, as mentioned above.

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* Syst. Av. Ethiopic. pp. 367–369.

† 'L'Oiseau,' 1932, p. 64 &c.

‡ Hist. Phys. Madag. &c., vol. xii. p. 348.

§ Vög. Madag. 1877, p. 144.

‖ *In litt.* to Sclater (Syst. Av. Ethiop. p. 368, footnote).

¶ Cassin, Proc. Acad. Philad. 1859, p. 41.

** Schlegel & Pollen, Rech. Faune Madag. t. ii. 1868, p. 89.

†† *Cf.* also Bates ('Ibis,' 1911, p. 629), who has discovered a difference in the shape of the spinal feather-tract in Pycnonotidæ and Timaliidæ, having a transversal branch in the first family.

‡‡ Vög. Madag. 1877, p. 165.

§§ Proc. Zool. Soc. 1866, p. 219.

‖‖ Hist. Phys. Mad. xii. p. 321.

As to the question to which group the Madagascar Timaliidæ are nearest allied—the Indian or the African—I must admit that I cannot give any satisfactory answer. The only characteristic of the Madagascar group, the strong development of lipochromes, is peculiar to it, and is not found in either the Indian or the African group, only some few of which—as some members of *Macrosphenus* and *Mixornis*—having comparatively well-developed lipochromes. The bill varies in all groups and cannot be used for comparison. However, it is worth noticing that the most primitive of the Madagascar Timaliidæ (viz., *Oxylabes madagascariensis*) has a chestnut, contrasting crown and occiput, as certain Indian Timaliidæ, *Malacopteron magnum*, and *Pellorneum subochraceum*, and I suggest the origin of the Madagascar group is to be found among such birds. Unquestionable, but difficult to explain, is the resemblance in coloration and shape of bill between our Madagascar birds and certain Pycnonotids, especially African forms. *Bleda syndactyla* has almost the same coloration and the same type of bill as *Bernieria*, and *Phyllastrephus terrestris* as *Oxylabes cinereiceps* &c. Also in these birds we find a rich development of lipochrome, and very likely the Madagascar Timaliidæ and the Pycnonotidæ are very closely allied, the first probably standing near to the ancestors of the bulbuls, which assumption justifies the common treatment of *Bernieria madagascariensis* as a Pycnonotid.

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* By some authors the Australian species are separated as *Pomatostomus* Cab.

† The African members are recently separated as *Pseudoalcippe* Bannerman, although they are very closely related to the Indian forms and structurally do not differ.

I may add that the strong difference in structure between the members of the Madagascar subfamily of the Timaliidæ is paralleled by the equally large variation in structures in other insular families, as, for instance, the Hawaiian Drepanididæ and the Galapagos Geospizidæ, and, the best example of all, the Madagascar Vangidæ, comprising such extremely different forms as the peculiar *Falculia*, *Eurycceros*, and *Xenopirostris*.

VIII.—*New Species of Heterocera from Tropical America.* By W. SCHAUS.

Noctuidæ.

Eutelia maryna, sp. n.

Male.—Palpi snuff-brown, the third joint whitish at base and tip. Head and collar in front dark neutral grey, the latter broadly chestnut-brown behind. Thorax deep mouse-grey, the tegulæ chestnut-brown; metathorax with a transverse line of pinkish-cinnamon hairs followed by a black line; a broad tuft of English-red hairs at base of abdomen and paired small dorsal tufts on following segments; abdomen above otherwise greyish olive, the small dorsal tufts tipped with English-red; anal hairs pale pinkish buff; a fine sublateral black line;

venter pale olive-buff; legs mottled white and cinnamon. Fore wing: inner margin to near cell and postmedial line dusky brown with an orange-cinnamon spot before the antemedial line; costal margin and most of cell light pinkish buff irrorated with black scales, forming black spots on basal third of costa; subcostal and median veins light pinkish buff; an antemedial line outbent on costa to subcostal vein, where it is inset, forming part of a semilunar line in cell proximally, below median vein slightly outcurved and vertical to inner margin; a short subbasal white line from cell; a V-shaped light pinkish-buff line in cell medially enclosing a triangular black spot with its base on subcostal, and followed by an almost quadrate fuscous spot at end of cell; a fine black excurved line on discocellular edged with light pinkish buff, preceded by another excurved black line, constricted medially; from cell at antemedial a pale line diverges slightly along the median vein, is toothed, and is upbent to the edging of the discocellular line; a thick postmedial fuscous double line joining and forming a curve at vein 7 is almost vertical to inner margin, the outer part of the line is outwardly edged with white to vein 6, then with dark lavender to inner margin, then with brighter lavender from below vein 5; termen Mars-brown at apex, narrowing to tornus; a subterminal white line, inangled on costa, outbent from vein 7 to vein 6 at termen; below vein 6, a broader line somewhat triangular to termen; a fine white line from costa before apex suffusing at vein 6 with fine white terminal lunules; cilia Mars-brown on interspaces, terminally paler. Hind wing above whitish to beyond middle, with some scattered brown hair-like scales; a thick line on discocellular, a fine postmedial line, and the termen broadly Natal-brown; cilia white, at base with fuscous lunules towards anal angle. Fore wing below fawn-colour, the inner margin and termen below vein 4 whitish: a postmedial white streak on costa. Hind wing below white; costa irrorated with fawn-colour; a Natal-brown thick line on discocellular; a lunular postmedial line; a dark terminal line, forming small triangular spots below veins 7–4.

Expanse 29 mm.

Habitat.—Itatiaya, Province of Rio de Janeiro.

Type.—Cat. No. 34521, U.S. N. M.

Gyrtonides fritzi, sp. n.

Female.—Palpi and collar mottled light drab and wood-brown, the front of collar fuscous. Head wood-brown with two small black spots on vertex. Thorax deep olive-buff with some silvery scales. Metathorax with lateral vinaceous-buff and silvery tufts. Abdomen above pale silvery drab-grey, with fine dark irrorations and some fuscous fine transverse lines, laterally and underneath pale cream-buff, in places suffused with silvery scales; three black lines from base, one medial, the other two diverging from base and none reaching last two segments, where the outer lines are replaced by black points, the anal hairs tipped with black. Legs mostly avellaneous, the fore tibia and tarsi black, the latter with pale spots; the mid-tarsi black above. Fore wing: costal margin for two-thirds deep olive, with small cinnamon spots on posterior edge; a broad white line from base to termen at subterminal line, partly filling cell; space below cell to inner margin and subterminal light brownish olive with darker antemedial and medial vertical lines; reniform fuscous with a pale centre and white edging, followed by a postmedial fuscous line from below costa forming two lunules, retracted at vein 3 to reniform; a broad terminal white space from apex to vein 5 preceded on costa by a thick, black, oblique line; below vein 5 the white space continues as a fine white line across the light brownish-olive terminal space; a white line along inner margin before the antemedial line; terminal black spots on interspaces proximally white-edged. Hind wing brownish olive; basal half of costa white; cilia silvery white. Wings below æneous-drab, the veins darker; fore wing with a white streak along anterior half of cell.

Expanse 24 mm.

Habitat.—Blumenau, Sta. Catharina.

Type.—No. 34528, U.S. N. M.

Named for Fritz Hoffman.

Coxina turibia, sp. n.

Female.—Palpi cinnamon-drab, irrorated with fuscous, the tips of second and third joints white. Head, collar, and thorax brownish drab; some whitish scaling on vertex, and black scaling on collar. Abdomen above hair-brown, underneath paler. Thorax below with white hairs; legs dark greyish brown, the tarsi paler with black spots. Fore wing: basal half sorghum-brown crossed by an antemedial dentate black line and limited by a similar medial line, both preceded by finer and fainter lines; a subbasal black line; postmedial line very irregular, dentate crenulate black, largely preceded and followed by chætura-drab shading, followed on costa by a large semicircular spot edged with black, broadly along distal edge, inwardly proximally white, also vein 8, the costal edge black with three maize-yellow lines, below costa some cinnamon-buff and fuscous scaling, forming a small round spot; a vertical subterminal cinnamon line edged with black lunules; black and cinnamon-buff marginal spots on interspaces; a wavy black pale-edged terminal line; cilia mostly fuscous. Hind wing benzo-brown; postmedial space below vein 5 buffish grey crossed by a medial and a postmedial finely wavy line; subterminal line as on fore wing, but parallel with termen; marginal spots and terminal line as on fore wing. Wings below drab suffused with light brown; fine medial and postmedial lines; marginal spots and terminal line as above, but fainter; the postmedial line on hind wing double, also a faint discal spot.

Expanse 36 mm.

Habitat.—Tucuman, Argentina.

Type.—Cat. No. 34520, U.S. N. M.

Collector R. Schreiter.

Lasiocampidæ.

Tolype gondoval, sp. n.

Male.—Antenna warm buff. Palpi fuscous with white rings. Head and collar benzo-brown. Thorax deep drab. Abdomen above deep quaker-drab, with transverse white lines, underneath pale drab-grey. Fore wing above: basal third white limited by a benzo-brown antemedial line, outcurved from costa across cell, slightly incurved between median and vein 2, then inbent to inner margin; a hair-brown streak from base along costal margin, not reaching the antemedial line, and similar suffusions at base below cell. Medial space dusky drab; a large black shade at discocellular and some ecru-drab scales below it; postmedial line broad, white, excurved from costa, angled at vein 8, excurved and angled at vein 4, again excurved, and outcurved on inner margin, outwardly edged by a fine drab-grey line and then by a broader pale drab-grey shade, ending at the subterminal light drab shade which runs parallel with the postmedial line; termen white; veins beyond postmedial line finely drab; cilia hair-brown. Hind wing above: basal half drab limited by a straight medial white line; the terminal half white suffused with pale drab-grey, except narrowly on termen, and is crossed by fine dark veins; cilia hair-brown. Fore wing below with the basal third brownish drab, the outer space drab-grey except on the white termen; indications of the postmedial and subterminal lines; black suffusion on discocellular. Hind wing below: basal half brownish drab, its outer edge outcurved from costa, incurved below vein 5; the black hairs on discocellular prominent; outer half as above.

Expanse 48 mm.

Habitat.—Itatiaya, Province of Rio de Janeiro.

Type.—Cat. No. 34526, U.S. N.M.

Tolype remphan, sp. n.

Male.—Antenna cinnamon-buff. Palpi fuscous. Head, collar, and thorax drab, the tegulæ laterally with pale drab-grey hairs. Abdomen above dark greyish olive with traces of paler segmental bands, underneath drab-grey. Fore wing above: a large buffy-brown triangular spot at base, limited by a thick, white, almost vertical line, then by a buffy-brown line, incurved to base at vein 1; medial space drab-grey with a large black spot on discocellular; postmedial line remote, buffy brown outwardly edged with white, vertical from costa to vein 5, slightly outcurved to vein 2, then vertical to inner margin, this line followed by drab-grey to a wavy subterminal drab line; termen narrowly pale drab-grey outwardly edged with buffy brown, which extends on cilia. Hind wing above whitish; a drab spot on discocellular, a fine outcurved dark postmedial line, and a broader subterminal drab line; termen and cilia as on fore wing. Fore wing below deep brownish drab, whitish on inner margin and along termen; a black discal point; a faint postmedial straight darker line outwardly edged with some white scaling at costa. Hind wing below white, the lines as above, the veins finely dark.

Female.—Antenna, head, collar, and fore part of thorax as in male, the thorax and tegulæ posteriorly drab-grey. Abdomen above and below light drab-grey with broad transverse drab lines; last segment and anal tufts fuscous-black. Fore wing above light drab, the lines drab; base suffused with drab; antemedial line out-angled on costa, then slightly inbent, proximally pale-edged; the black discal spot large; postmedial line remote, outbent on costa, inbent and sinuous to inner margin, distally edged with whitish; subterminal line whitish, parallel with postmedial, somewhat macular towards costa; cilia narrowly benzo-brown at base. Hind wing above whitish drab, the veins finely darker; traces of a dark line on discocellular. Wings below whitish drab, the veins finely darker; fore wing with the costal half and termen suffused with drab, the discal spot and postmedial line visible in transparency; hind wing below with traces of a drab postmedial and subterminal shade.

Expanse, male 41 mm., female 65 mm.

Habitat.—Virginia, S. Minas Geraes, at 1500 metres.

Type.—Cat. No. 34522, U.S. N. M.

Allied to *T. serralta* Jones.

Tolype dolesia, sp. n.

Male.—Antenna pinkish buff. Palpi fuscous. Head, collar, thorax, and the very long anal hairs hair-brown. Abdomen above hair-brown with faint traces of transverse pale lines. Fore wing above thinly scaled, light drab; base of costa suffused with hair-brown; the two lines faint, ecru-drab, the antemedial slightly oblique, inbent to base at vein 1, the postmedial sinuous, outcurved at costa and below vein 5; cilia hair-brown. Hind wing above thinly scaled, drab-grey, suffused with drab on inner margin and termen; a very faint postmedial curved drab line. Fore wing below drab, the veins darker; a fine white line on discocellular. Hind wing below light drab, the postmedial line better defined.

Female.—Body as in male, the anal hairs fuscous, short and thick-set. Fore wing above as in male, the lines broader, the basal suffusions forming a triangular patch; the termen narrowly ecru-drab; a hair-brown spot on discocellular. Hind wing as in male, but without darker shading on inner margin. Wings below thinly scaled, pale ecru-drab, the fore wing with a faint whitish line on discocellular, the hind wing with a faint, pale, postmedial line.

Expanse, male 32 mm., female 48 mm.

Habitat.—Virginia, S. Minas Geraes.

Type.—Cat. No. 34524, U.S. N.M.

The female is abnormal in having vein 6 of fore wing forked near termen.

Near *T. undulosa* Walker; the female quite different.

Tolype rinchois, sp. n.

Male.—Antenna cinnamon. Head and body fuscous, the abdomen mottled with long benzo-brown hairs terminally. Fore wing above benzo-brown, the lines very fine, whitish buff; antemedial line inbent from costa to vein 1, distally edged with fuscous and closely followed by a large black spot on discocellular; postmedial line parallel with termen, almost straight; cilia fuscous. Hind wing above hair-brown, paler at base; a fuscous streak on discocellular and a faint darker postmedial line. Wings below slightly paler; fore wing with fuscous suffusions on costa, the postmedial line indicated in transparency; the hind wing as above.

Female.—Head, collar, and thorax benzo-brown; abdomen buffy brown; anal hairs black, forming a large expanding cluster. Wings drab. Fore wing: the lines expanding slightly on costa; a thick black line on discocellular; the veins at base buffish; cilia benzo-brown. Hind wing: a fuscous line on discocellular. Wings below thinly scaled, drab; faint dark lines on discocellular.

Expanse, male 35 mm., female 52 mm.

Habitat.—Virginia, S. Minas Geraes.

Type.—Cat. No. 34523, U.S. N. M.

Near *T. undulosa* Walker; the termen of male not so oblique.

Artace neeltje, sp. n.

Male.—Palpi fuscous fringed below with Orient-pink. Head and collar pallid mouse-grey. Thorax and abdomen above mouse-grey, the anal segment and hairs white; underneath mouse-grey with some medial black scaling. Fore tarsi deep mouse-grey with some paler mottling.

Fore wing pale drab-grey, the lines greyish olive; iridescent pale blue in cell and beyond to medial line, also between medial and postmedial from veins 6 to 11; basal and subbasal lines on interspaces; antemedial line sinuous and inbent below subcostal; medial line outcurved on costal margin, slightly lunular and inbent to inner margin, followed by a much fainter parallel line; postmedial line similar to medial line and parallel with it; subterminal line double from vein 6 to inner margin; a broad line at base of cilia on interspaces, the tips white. Hind wing greyish white; a faint subterminal light greyish-olive shade. Fore wing below light greyish olive with traces of lines. Hind wing below as above.

Expanse 26 mm.

Habitat.—Itatiaya, Province of Rio de Janeiro.

Type.—Cat. No. 34511, U.S. N. M.

Nearest *A. helier* Schaus.

Artace itatiaya, sp. n.

Male.—Head white, laterally black, the palpi strawberry-pink. Collar and thorax light mouse-grey. Abdomen dorsally mouse-grey, becoming paler terminally, the anal hairs white; underneath mouse-grey on basal half, white on terminal half. Fore tarsi pallid mouse-grey, crossed above by black bars. Fore wing white, faintly suffused with pallid mouse-grey from cell to inner margin; costal edge to antemedial strawberry-pink; veins 1 to 4 with fine black streaks beyond medial line; basal, subbasal, and antemedial fuscous spot on veins, those on costal margin of antemedial forming short streaks; spots at upper and lower angles of discocellular; a medial line of three larger spots from vein 5 to costa, below vein 5 small, inbent, approaching the antemedial on inner margin, all followed by a series of faint spots; a postmedial series of spots on veins parallel with termen, closely followed by a subterminal thick drab line interrupted by veins; terminal black spots on interspaces; cilia white. Hind wing white, the inner margin with drab-grey hairs, expanding at anal angle, with a faint subterminal similar shade; veins terminally faintly drab-grey. Fore wing below drab-grey, darker before the narrow white termen; veins mostly drab; medial dark points on veins; the terminal spots as above. Hind wing below white; a series of subterminal faint drab-grey spots on interspaces becoming almost obsolete towards apex; a fine drab-grey terminal line.

Expanse 32 mm.

Habitat.—Itatiaya, Province of Rio de Janeiro.

Type.—Cat. No. 34510, U.S. N. M.

Artace anetje, sp. n.

Male.—Palpi light mouse-grey, the third joint roseate. Head, thorax, and abdomen lilac-grey; underneath whitish. Fore tarsi above paliid mouse-grey crossed by black bars and with roseate scaling at base and on inner edge. Fore wing above pale mouse-grey, the costa white to subterminal line, the veins and termen narrowly white; basal, subbasal, antemedial, medial, and postmedial black streaks on veins, also a broken line on discocellular, the antemedial and medial parallel from cell to inner margin; the cell and space beyond to postmedial, also a subterminal series of spots between veins, very faint between veins 4 and 6, mouse-grey; rather large terminal black spots on interspaces; cilia white. Hind wing white, the inner margin with some mouse-grey hairs; a terminal deep mouse-grey line on interspaces. Fore wing below deep mouse-grey above median, light mouse-grey below median; the apex narrowly white; terminal spots as above. Hind wing below white, the terminal line as above.

Expanse 31 mm.

Habitat.—Itatiaya, Province of Rio de Janeiro.

Type.—Cat. No. 34509, U.S. N. M.

Allied to *Artace albicans* Walker.

Euglyphis braganzina, sp. n.

Male.—Antenna, palpi, head, thorax, and abdomen vinaceous-russet. Collar and tegulæ white with slight greyish mottling; a dorsal rood's-brown line from head, crossing collar and edging dorsally the tegulæ. Legs vinaceous-russet, the mid-tibia and fore femora mottled with white hairs. Abdomen below with darker mottling; mid-tibia and tarsi fringed with white hairs. Fore wing above whitish, the veins on terminal space more densely scaled with a few snuff-brown irrorations; a small sayal-brown and black spot near base of costa; a black streak at base of cell; scattered black scales from traces of an antemedial and a medial line; an interrupted, fine, oblique black line on discocellular; inner margin narrowly, and cilia vinaceous-russet; some irregular black markings along vein 1 forming beyond middle an upturned wavy black line to vein 5; outwardly edged with clusters of vinaceous-russet scales irrorated with black, those between veins 3 and 4 reaching the subterminal line; an elongated vinaceous-russet and fuscous spot on costa before apex; subterminal line very fine, double excurved between veins 6 and 3; narrow fuscous lunules on termen. Hind wing above: costal half white irrorated with fuscous; a vertical postmedial fuscous line from costa to vein 5, and traces of postmedial and subterminal faint lines; a marginal cinnamon line; inner half of wing brownish vinaceous; base of cilia fuscous on interspaces.

Female.—Antenna, palpi, head, thorax, and abdomen above and below russet-vinaceous; collar medially, tegulæ dorsally broadly sayal-brown, also base of abdomen; collar and tegulæ outwardly white with brown irrorations; mid-tibia and tarsi without white hairs. Fore wing above white, thickly irrorated with black and sayal-brown; costal edge and inner margin finely, the termen more broadly cinnamon; a subbasal thick cinnamon line across costa and cell, and a similar elongated spot on costa before apex; a sayal-brown fine medial line suffusing at lower angle of cell with a fine black oblique line on discocellular, angled at vein 2 and wavily downbent to inner margin; postmedial line fine, outbent on costa to vein 8, angled and sinuously inbent, parallel with medial line; subterminal line outcurved from costa, below vein 2 approximated to postmedial, these two last lines partly edged with clearer white; a marginal interrupted line of small spots edged by a lunular whitish line; cilia sayal-brown, slightly white at base. Hind wing: costal margin, cell, and beyond to near termen white irrorated with sayal-brown crossed by a vertical verona-brown postmedial line, followed by a more diffuse line; inner half of wing tawny-olive, also the termen; a subterminal lunular white line not reaching inner margin, edging small dark lunules. Wings below cinnamon. Fore wing with subterminal dark streaks on interspaces.

Hind wing with a short white line at apex. The base of cilia on both wings sayal-brown.

Expanse, male 35 mm., female 50 mm.

Habitat.—Itatiaya, Province of Rio de Janeiro.

Belongs to the group of *E. braganza* Schs., and is nearest *E. obliterata* Schs. It is well to mention here that all the species from Itatiaya were received from my friend J. F. Zikan, and were collected at an elevation of 700 metres.

Type.—Cat. No. 34525, U.S. N. M.

Notodontidæ.

Calledema ronaldi, sp. n.

Male.—Palpi: first and second joints cinnamon fringed below with violet-grey, the second with white tip, the inner side white; third joint avellaneous. Head and collar fawn-colour mottled with white and avellaneous. Thorax pale drab-grey with a few scattered black scales and drab-grey suffusions. Abdomen above greyish olive with transverse whitish lines; dorsal white spots on two basal segments and some dorsal amber-brown scales on fourth segment; anal segment pale vinaceous-fawn. Abdomen and thorax below white; fore femora with large white tufts; mid and hind legs mostly buffy brown, the femora with white hairs; hind tibia white at joints. Fore wing above pinkish buff; costal edge violet-grey at base, medially pale drab-grey, then violet-grey crossed by fine pale lines, and beyond black markings interrupted by white spots; some black scales at base; subbasal black scales on costa and inner margin; antemedial double black lines on costa separated by vinaceous-fawn and followed along upper edge of cell by a Mikado-brown streak to end of cell; traces of a double medial clay-coloured line in cell partly black between fold and vein 1, single on inner margin; discocellular with a snuff-brown line on lower half, and a similar small spot above it edged with silver; a silver streak on vein 5 to subterminal line, containing at its end a small brownish streak and edged below with Mikado-brown; a medial black point below cell; a postmedial sayal-brown outcurved line, only noticeable below vein 4 where it is deeply dentate to fold, then wavy to inner margin; veins 1, 2, and 3 postmedially with black streaks ending distally in black points; in places this line is faintly double; base of vein 8 and vein 6 finely outlined in silver; subterminal line white, excurved from costa to vein 7, below vein 5 parallel with termen, broadly edged distally between veins 5 and 8 with capucine-buff; termen greyish olive and cinnamon-drab proximally edged by a white line, crenulate from vein 8 to vein 4 then parallel with termen, and crossed by oblique white lines from each vein to termen, the line between veins 5 and 4 lunular; cilia white. Hind wing above buffy brown, the inner margin whitish; cilia white. Fore wing below buffy brown, the margins narrowly whitish; a terminal dark crenulate line, greatly reduced and partly punctiform on one wing from vein 4 to costa. Hind wing below whitish; a broad marginal buffy-brown shade.

Expanse 40 mm.

Habitat.—Itatiaya, Province of Rio de Janeiro.

Type.—Cat. No. 34519, U.S. N. M.

Epiinæ.

Epia parsenia, sp. n.

Female.—Head, antenna, and palpi apricot-buff. Collar and tegulæ orange-cinnamon. Thorax deep mouse-grey. Abdomen above hazel, the last segment deep mouse-grey outwardly edged by a white line, laterally orange-cinnamon, the venter apricot-buff. Fore wing: costal margin ochraceous-salmon, also the base of cell and below it; inner margin and below vein 2 cinnamon-drab, with a broad Prout's-brown diffuse shade from a subbasal darker transverse line to near the subterminal line; a Prout's-brown shade from upper angle of cell extending below costa but not reaching the subterminal line; subterminal line smoky white gently curved and parallel with termen, preceded throughout by light drab, extending between veins 2 and 4 to cell; termen light drab with a dark vinaceous-drab marginal shade, much darker at tornus; from postmedial line below costal edge a broad bay streak to termen. Hind wing above light drab, the inner margin broadly hair-brown; a faint smoky-white subterminal line; termen from below vein 3 to anal angle orange-rufous edged above with fuscous. Wings below drab, the subterminal white line better defined, the termen deep brownish drab; costal margins ochraceous-orange, narrower on hind wing; the terminal markings before anal angle of hind wing as above.

Expanse 74 mm.

Habitat.—Chanchamayo (?), Peru.

Type.—Cat. No. 34501, U.S. N. M.

The dealers who send material out from Chanchamayo have their collectors cover hundreds of miles on their expeditions, besides working from 2000 to 8000 feet elevation.

ZANOLINÆ.

Colabata eadgara, sp. n.

Male.—Antenna with the shaft above fuscous, also the tips of pectinations; the shaft laterally white, the base of pectinations pale pinkish buff. Palpi black above, the long fringe cinnamon-buff. Frons white mottled with hair-brown. Collar and tegulæ white thickly mottled with sayal-brown; a medial line on thorax and a transverse line below middle of tegulæ snuff-brown. Abdomen above white, obscured by dense fawn-colour irrorations, underneath with fine white transverse lines. Legs thickly mottled white and Natal brown. Fore wing above white densely irrorated with army-brown and deep olive-buff crossed by three fine sayal-brown straight lines, the antemedial inbent from costa to inner margin, proximally pale-edged, the postmedial line double, well apart, also inbent, more remote from antemedial on costa than on inner margin, the outer line distally pale-edged; a black point on discocellular; a subterminal deeply lunular line inwardly pale-edged, more broadly so between veins 4 and 6, and on inner margin with tawny-olive suffusions; cilia snuff-brown. Hind wing paler; inner margin to postmedial line broadly cinnamon-rufous; traces of a medial darker line; a fine distinct postmedial line followed by a broad brownish-drab shade. Fore wing below light buff, whiter on inner margin, faint traces of the postmedial and subterminal lines, costal margin white with fuscous irrorations, fewer on the apex; a fine line on discocellular. Hind wing below pinkish buff in and below cell to postmedial line, and on termen thickly irrorated with sayal-brown; costa white with fuscous irrorations; inner margin broadly light pinkish buff; medial and postmedial lines fine, sayal-brown, slightly excurved from costa to below vein 6, rounded and inbent, not reaching extreme inner margin; a large benzo-brown spot follows the postmedial line on costa, below it a broad hair-brown shade to anal angle.

Expanse 46 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34508, U.S. N. M.

Mimallonidæ.

Mimallo garretti, sp. n.

Female.—Antenna: shaft pale olive-grey, the pectinations avellaneous. Head whitish; two black spots on frons and a black mark on vertex. Collar and thorax light drab-grey. Abdomen dorsally light cinnamon-drab; underneath pale drab-grey. Fore wing above pale drab-grey suffused with silvery scales; a fine fuscous line on discocellular outwardly edged with a silvery-white spot; a faint postmedial line oblique and outbent below vein 8, shortly outcurved, and inbent to inner margin beyond middle, well defined, chestnut-brown, distally edged by a warm buff line and hair-brown suffusion, these last expanding between veins 5 and 2 and again at tornus. The termen is slightly rounded and excurved at tornus. Hind wing pale drab-grey on basal half, the transverse line as on fore wing, the suffusions expandng between veins 5 and 2. Hind wing broad, the termen well rounded, slightly excurved at apex. Wings below light drab-grey with some scattered black scales; the postmedial line on both wings fine, very indistinct, following the outline of the distal edge of suffusions on upper side.

Expanse 42 mm.

Habitat.—Itatiaya, Province of Rio de Janeiro.

Type.—Cat. No. 34516, U.S. N. M.

Psychocampa veigli, sp. n.

Male.—Head and collar ochraceous-buff with a few black scales, the collar with a line of fuscous hairs close to posterior edge. Thorax cream-white, the abdomen light buff, both with a few black scales. Wings cream-white with scattered black scales. Fore wing: a faint, fine, dark medial line outwardly shaded from costa to vein 2 with pale avellaneous; a hyaline spot edged with black, broader and indentate on distal edge; an outbent drab-grey line from costa, sharply angled at vein 8, suffusions with a thick fuscous line from apex, this line slightly incurved to inner margin beyond middle; a fine line of black and cinnamon-drab scales, oblique from vein 4 to tornus; termen narrowly smoke-grey with some dark scales on inner edge from vein 7 to vein 5. Hind wing with a medial fuscous line preceded by a double black-edged hyaline spot, some cinnamon-buff shading between veins 2 and 4 on both sides of line. Fore wing below pale pinkish buff, the end of cell and beyond to outer line suffused with cinnamon; the line fainter, excurved from vein 8 to vein 4, angled, slightly incurved to vein 3, then inbent, vertical and thicker to inner margin. Hind wing below with fewer irrorations; the hyaline spot broadly edged with black; postmedial line outbent from costa, excurved opposite cell, and again from vein 2 to inner margin.

Expanse 46 mm.

Habitat.—Virginia, S. Minas (Faz Campos), Brazil.

Type.—Cat. No. 34515, U.S. N. M.

Allied to *Psychocampa beta* Schaus.

Cicinnus sachinius, sp. n.

Female.—Head, collar, and a spot on fore legs ochraceous-salmon. Thorax ochraceous-buff with scattered black scales, and similar scales on collar. Abdomen above drab-grey with some black scales, underneath avellaneous. Wings above very pale drab-grey irrorated with scattered black scales; medial space slightly suffused with light cinnamon-drab; a hyaline dark-edged spot at end of cell cut by vein 5; a fine black line outwardly edged with tawny-olive, excurved and very oblique from costa to close to apex at vein 8, then sharply angled and inbent to inner margin postmedially. Hind wing with the postmedial line of fore wing continued to inner margin. Wings below deep olive-buff thickly irrorated with black scales; a faint subterminal darker line on both wings.

Expanse 56 mm.

Habitat.—Passo Quatro, Minas, Brazil.

Type.—Cat. No. 34514, U.S. N. M.

Closely allied to *C. despecta* Walker, differing chiefly in the markings of the underside.

Trogoptera dietricha, sp. n.

Male.—Antenna with the shaft wood-brown, the pectinations fuscous, the pectinations are long on basal two-thirds, then short. Head and collar vinaceous-buff; thorax and abdomen above tawny-olive, the abdomen underneath pale buff, the thorax below tawny-olive; the fore legs sayal-brown with long darker hairs on tibia. Fore wing clay-colour on less than basal half, crossed by fine and faint subbasal and antemedial sinuous lines; a fine whitish lunule on discocellular; outer half of wing sepia crossed by a fine fuscous line, outcurved around end of cell; costal margin clay-colour, expanding beyond a faint fuscous postmedial line to apex; cilia tipped with light pinkish cinnamon. The apex of fore wing is acute, slightly excurved to vein 3, more so between veins 3 and 2, then deeply excurved to inner margin. Hind wing sepia with slight clay-colour suffusions at base and apex. The hind wing is twice excurved at apex. Fore wing below cinnamon-buff on basal half, somewhat metallic on inner margin; a white line on discocellular, the line following it broader and more distinct, fuscous preceded by pale drab-grey suffusion, extending to apex and tornus. Hind wing below deep greyish olive crossed by a fuscous medial line; base narrowly clay-colour.

Expanse 34 mm.

Habitat.—Itatiaya, Province of Rio de Janeiro.

Type.—Cat. No. 34517, U.S. N. M.

Near *T. subrufescens* Dognin.

Lacosoma maldera, sp. n.

Male.—Head, collar, thorax, and abdomen laterally shell-pink, the abdomen dorsally buff-pink; a few dark scales on tegulæ and laterally on abdomen. Body below whitish, the fore legs buff-pink. Wings above shell-pink with some scattered black scales. Fore wing produced at apex, excurved below apex, below vein 3 inbent, slightly excurved above and below vein 2; costal edge and cilia buff-pink; traces of a very fine, faint, antemedial line; a fine postmedial line slightly sinuous. Hind wing broad, the termen faintly crenulate slightly produced at vein 4, the anal angle acute; a faint medial line; a few dark scales on discocellulars of both wings. Wings below somewhat darker, with a few scattered black scales; postmedial line on fore wing distinct at costa, on hind wing indicated by black scales.

Expanse, male 34 mm., female 40 mm.

Habitat.—Itatiaya, Province of Rio de Janeiro.

Type.—Cat. No. 34513, U.S. N. M.

Close to *L. lygia* Schaus.

Cossidæ.

Xyleutes votani, sp. n.

Male.—Antenna black. Head, collar, and thorax white with medial irregular black markings and scattered black scales. Abdomen above white at base with black dorsal spots, otherwise with alternate greyish-white and black transverse bands; underneath light greyish olive with white transverse lines. Fore wing above white; costal margin with small triangular black spots; the cell with small spots and transverse lines; a large quadrate black spot at discocellular, its corners shortly produced; a broad black mark from base of costa to median vein at one-fourth of wing, its lower edge irregular, edging an irregular white line; a mottled white spot at base of inner margin; inner margin to near termen broadly greyish olive crossed by numerous black lines; medial space below cell with fewer transverse lines, followed by a quadrate black spot, with a small adjoining spot at base of vein 2; terminal third with numerous transverse lines on interspaces and finer lines or dots between them; some small subterminal black spots on veins; small terminal black spots on veins. Hind wing white with numerous transverse lines; the inner margin hair-brown; terminal black spots extending on the white cilia. Wings below as above, but more subdued.

Expanse 68 mm.

Habitat.—La Rioja, Argentine Republic.

Type.—Cat. No. 34518, U.S. N. M.

Allied to *X. melanoleuca* Burmeister; differs in markings and black antennæ.

Inguromorpha buboa, sp. n.

Male.—Palpi and head white. Collar and thorax orange-cinnamon, the tegulæ mottled with white, especially in front. Abdomen above white mottled with drab, crossed by cinnamon-drab lines, the dorsal tufts on basal half grenadine, underneath whitish buff; legs clothed with white hairs, all the tarsi black with white rings. Fore wing: costal margin drab-grey with black spots partly white edged; a short curved orange-cinnamon basal line; antemedial space narrow, drab-grey edged outwardly from subcostal to inner margin by a vertical, sometimes broken, orange-cinnamon line distally white-edged; medial space below cell mouse-grey crossed by faint vinaceous-cinnamon lines; a medial small dark spot in cell and a large cinnamon-orange round spot before end of cell, edged with fuscous; inner margin below vein 1 faintly darker, separated by fine vertical pale lines forming quadrate spots also suffused with orange-cinnamon, the spot below vein 2 extending upward; an irregular white line on discocellular; postmedial space whitish striated with pale mouse-grey, followed by drab-grey blotches between the veins, striated with pale cinnamon-orange, the veins with a few white points; a subterminal lunular white line edging large terminal blotches, suffused with pale cinnamon-orange, the terminal spots between veins 5 and 7 mottled cinnamon-orange and black, and are distally edged by a white line and then the narrow marginal mouse-grey line which is incurved, expanding above vein 7; from vein 7 to vein 3 the terminal white line is interrupted by small chestnut lunules, below 3 by cinnamon-orange mottling. Hind wing greyish white, the veins pale olive-buff; a subterminal greyish-olive spot above vein 5; traces of faint double subterminal lines below vein 2 to inner margin, where they are better defined; terminal dark scaling across the veins and a darker spot at tornus. Fore wing below drab, below cell and vein 2 vinaceous-cinnamon; costal margin white with black spots from base to above discocellular; an irregular fuscous spot before end of cell; marginal fuscous spots between veins 5 and 7. Hind wing below white, the cell and below it and vein 2 suffused with pinkish buff;

costa white crossed by thick black lines; the markings otherwise as above.

Expanse 23 mm.

Habitat.—Sta. Catharina.

Type.—Cat. No. 34529, U.S. N. M.

Hemipectrona charmion, sp. n.

Male.—Palpi with the shaft white, the pectinations buff. Frons white mottled with brown, the vertex and a line extending on to frons, also the thorax, chestnut-brown with some hazel hairs; collar mottled chestnut-brown and white; tegulæ mostly light greyish olive. Fore wing: basal third pale olive-buff from below costa; base of costa and antemedial space dark olive-buff suffused with wood-brown; veins from middle of wing to postmedial line white; medial space with a series of small spots on interspaces from costa to median vein, these spots towards base fuscous, outwardly deep olive-buff, below median to vein 1 two large fuscous spots, the smaller spots above median followed by an oblique white and deep olive-buff broad shade from costa to lower angle of cell, below cell inbent and narrow to the white inner margin; an oblique and incurved sinuous white line from below costa to vein 2, preceded on interspaces by series of vertical fuscous streaks, followed by a broad, semicircular, chestnut-brown fascia, expanding and anteriorly rounded, outwardly incurved and outbent to termen above vein 4, with a branch extending to termen at vein 2 enclosing a small white spot; some white within the upper curve above vein 5; apex whitish buff; brown terminal suffusions below apex. Hind wing buffy brown, the costal margin white, the inner margin olive-buff; cilia white. Fore wing below pale olive buff on costa, termen, and inner margin, otherwise largely suffused with citrine drab. Hind wing below deep olive-buff, the costal margin narrowly white.

Expanse 31 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34499, U.S. N. M.

Langsdorfia sieglinda, sp. n.

Male.—Antenna: shaft light buff, the pectinations vinaceous-buff. Palpi, head, and thorax above and below, also fore and mid-legs, black. Abdomen above and midlegs citrine drab; anal hairs and hind tibia olive-buff, the latter with small dusky spots. Fore wing fuscous, consisting of contiguous wavy scales; from beyond cell to apex a large creamy-white spot, its proximal edge pointed and excurved before reaching costal margin, which is crossed by black lines to apex, its lower edge gently curved to apex; faint marginal small whitish spots on interspaces; cilia black divided by a faint pale line. Hind wing dull drab, the costa and apex narrowly whitish; cilia with pale tips. Fore wing below hair-brown; costa with light buff spots from before middle to apex; the apical spot reduced to a curved line; the marginal spots larger than above. Hind wing below buff-white; cilia deep olive-buff.

Expanse 30 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34481, U.S. N. M.

Givira isarba, sp. n.

Male.—Frons pale drab-grey with a bifurcating fuscous line. Collar and thorax black; tegulæ in front pale smoke-grey, otherwise drab with a fuscous line on dorsal edge. Abdomen above with the segments broadly black in front, posteriorly mottled with colonial buff; underneath bone-white with black and wood-brown irrorations. Fore wing whitish, almost obliterated by hair-brown irrorations; base colonial buff with a line of small black spots from costa to median vein; antemedial line slightly outcurved, macular, black; medial space lightly suffused with deep greyish-olive-grey, crossed by lines of small black spots; postmedial round black spots on costa between veins 5 and 7 and a smaller outset spot on vein 4; deep greyish-olive suffusions between veins 3 and 5, crossed by a fine fuscous line from vein 5 to inner margin; an outcurved subapical series of three smaller black spots; traces of a subterminal, irregular, fine fuscous line; cilia mostly neutral grey. Hind wing whitish with numerous transverse lines, mostly interrupted by veins. Fore wing below: base, costa, apex, and inner margin whitish, otherwise suffused with deep greyish olive, the lines and spots faint, only the subapical spots more distinct; three triangular black spots on costa beyond middle. Hind wing below whiter, the costa with well-marked black spots.

Expanse 33 mm.

Habitat.—La Rioja, Argentine Republic.

Type.—Cat. No. 34512, U.S. N. M.

Givira villetta, sp. n.

Male.—Palpi benzo-brown. Head and collar thickly mottled benzo-brown and pale smoke-grey. Thorax and base of abdomen with the smoke-grey scaling predominating; abdomen terminally mottled with Mikado-brown. Fore wing light cinnamon-drab, becoming darker on outer half; costal margin with numerous black lines; the wing reticulated with numerous fine dark lines, sometimes conjoined, forming small annuli; the interspaces with some silvery-grey scaling; from near base on inner margin an irregular black line crossed by some erect black lines and not reaching tornus. Hind wing paler, suffused with iridescent pale blue on interspaces; the reticulations also paler than on fore wing and without any black; cilia tipped with pinkish cinnamon. Wings below paler, the reticulations on fore wing fewer, the inner margin white; the costa of hind wing with distinct transverse fuscous lines.

Expanse 34 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34500, U.S. N. M.

Givira isolde, sp. n.

Female.—Palpi and throat black. Frons benzo-brown with lateral black lines. Vertex and front of collar fuscous, the latter medially buffy brown, terminally with some white hairs; tegulæ fuscous; metathorax with long vinaceous-buff tufts. Abdomen above hair-brown on basal half, the terminal half with pale vinaceous-fawn hairs. Thorax below silvery white and similar long hairs on hair-brown fore tibia. Fore wing: costal margin, cell, and below cell to vein 1 silvery white, with quadrate olive-buff spots, an almost medial curved series of black streaks from subcostal to median vein; below vein 1 dark greyish olive from base to vein 2; large similar spots on interspaces adjoining cell from vein 2 to vein 7, these followed by deep greyish-olive spots, becoming smaller towards vein 7, and again followed by a white line which bifurcates at vein 4, sending a fine white line to costa and a broader line which becomes terminal; the marginal interspaces above vein 4 dark greyish olive; termen olive-buff, below vein 4 forming irregular spots. Hind wing dark smoky olivaceous, the termen white from below apex. Fore wing with the markings duller and suffusing, the white marginal lines present. Hind wing below: the costal edge olivaceous-black, otherwise largely suffused with greyish olive, leaving the termen and a space below costa from base to apex white.

Expanse 30 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34483, U.S. N. M.

Two specimens in National Museum.

Givira argentipuncta, sp. n.

Male.—Antenna benzo-brown. Palpi and frons cinnamon-drab; vertex and collar deep purplish grey. Tegulæ and thorax white. Abdomen above deep greyish olive with white segmental lines, the anal hairs white tipped with black, underneath white. Thorax below mostly white suffused with deep greyish olive, the hind tibia white tipped with black. Fore wing light cinnamon-drab, the termen broadly pale ecru-drab; costal margin pinkish buff with some dark spots; some white and black scaling at base of wing; space below cell to vein 1 benzo-brown with a large round silver spot; inner margin from base to vein 2 silvery white crossed by irregular benzo-brown lines; the outer portion of wing with some small dark spots, chiefly in pairs at veins. Hind wing from base suffused with light cinnamon-drab, becoming paler on termen; inner margin broadly suffused with hair-brown. Fore wing below drab, the veins whitish; costa ecru-drab with a series of black spots; traces of dark lines on terminal half. Hind wing below with the costa white crossed by numerous black lines.

Expanse 40 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34482, U.S. N. M.

Two specimens in National Museum.

Thyrididæ.

Striglina medara, sp. n.

Male.—Head, body, and wings vinaceous-rufous. Wings thickly mottled with drab, forming annuli and striæ, and irrorated with scarlet; termen crenulate, medially produced; a terminal chestnut fine line; basal half of cilia ferruginous outwardly edged by black, the tips white on interspaces. Fore wing: costal edge finely white, interrupted by ferruginous; a small fuscous annulus at end of cell. Hind wing: small antemedial and medial hyaline spots. Wings below largely flesh-ochre mottled with rufous annuli on interspaces, the terminal line and cilia not so red.

Expanse 37 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34493, U.S. N. M.

Allied to *Striglina pyrostola* Hampson.

PYRAUSTINÆ.

Megastes zarbinalis, sp. n.

Female.—Palpi deep olive-buff, at base white. Head tilleul-buff divided by a fuscous line on frons. Collar, pale pinkish buff suffused anteriorly with drab-grey outwardly darker. Thorax hair-brown; metathorax pale pinkish buff. Abdomen above: a pale cream-colour dorsal line edged with hair-brown, the segments crossed by fine hair-brown lines, thus forming large subdorsal pale cream-colour spots outwardly edged by a fine hair-brown line, forming with the sublateral hair-brown line large, pale, lateral spots; abodmen below pale cream-colour, with oblique, fine dark lines on segments. Fore wing above thinly scaled on pale portions, light pinkish cinnamon, paler along costa and on veins beyond cell, the markings hair-brown; a space at base from below costa to inner margin, its outer edge inbent, crossed by a subbasal line of ground-colour; a fine dark antemedial line outbent from costa, incurved below vein 1, faintly interrupted, followed by a small annulus in cell, one below cell touching the antemedial line, and a larger annulus below vein 1, its proximal edge formed by the antemedial line; an almost quadrate spot at discocellular containing pale scaling, and on one wing with a dark point, below it a curved line proximally extending to inner margin, distally suffusing with a large elongated, triangular patch, its upper edge oblique to tornus, its proximal edge slightly incurved; postmedial space from vein 7 to vein 2 thinly irrorated with drab, and with small drab spots between veins 3 and 5 near cell; subterminal line outcurved from costa to vein 6, then sinuous and wavy to tornal patch; a terminal dark line from vein 8 to vein 4 adjoining a small hair-brown spot between veins 5 and 6; cilia cream-colour, crossed by a fine interrupted dark line; the tips hair-brown. Hind wing white, semihyaline; a subterminal hair-brown line, below vein 5 outset, very fine to vein 2; a fine terminal dark line, broader above vein 6, and below vein 2 to near anal angle; a black point on discocellular; dark postmedial points above and below fold; cilia with the tips almost white. Wings below white, the costal margins more densely scaled; forewing without the dark patches at base and tornus, the markings of upperside faint but visible; hind wing below as above, the subterminal line double above vein 6 to costa.

Expanse 52 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34502, U.S. N. M.

Azochis tallasalis, sp. n.

Male.—Palpi raw-sienna. Head, collar, and thorax black, the thorax and tegulæ dorsally with some white hairs. Abdomen dorsally at base white, with dorsal and lateral fuscous and black spots; medial segments mottled black and cinnamon-drab; terminal and anal segment white and light drab, with paired short black lines; tibia mostly white, the tarsi pale pinkish buff. Fore wing thinly scaled seashell-pink; base black, extending slightly on costa and inner margin, and containing some iridescent blue scales, followed closely by a curved, fine fuscous line; a small fuscous annulus in cell medially containing some warm buff scales; a dark streak on costa above discocellular, with a warm buff line on discocellular finely edged with black; a fine dark wavy line below end of cell to inner margin; a subterminal, fine wavy, dark line well outcurved from costa suffusing with a dark terminal line between veins 2 and 3;

a black spot on termen below vein 2; a terminal black spot between veins 5 and 6; termen otherwise narrowly light buff with dark points on it above veins 6 and 7. Hind wing semihyaline white; a smoky faint medial line from vein 2, terminating in a small black spot close to inner margin; a subterminal smoky line from vein 6 to vein 5, then slightly outcurved to termen below vein 2, termen from apex to vein 4 rather broadly black; base of cilia black from apex to vein 4, then reduced to small black spots at veins; tips of cilia white. Fore wing below pale pinkish buff, the markings reduced. Hind wing below as above, but without the medial dark spot near inner margin; the costal margin thickly scaled, white.

Expanse 40 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34503, U.S. N. M.

Allied to the variable *A. gripusalis* Walker.

Noctuelia anubisalis, sp. n.

Female.—Head and body black; head with a transverse line of orange hairs behind and some similar short hairs dorsally on abdomen at base; abdomen below drab; legs light drab. Fore wing above deep chrome; costal edge black; inner margin black, extending above vein 1 at one-third from base to termen; apex very broadly black, not extending below vein 3; a black streak in cell expanding towards end of cell and downbent on discocellular. Hind wing black. Fore wing below as above, the line in cell finer. Hind wing below black. Cilia on both wings black.

Expanse 31 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34504, U.S. N. M.

Three specimens in National Museum.

CRAMBINÆ.

Doratoperas nabalalis, sp. n.

Male.—Head, collar, and thorax fawn-colour slightly suffused with purplish. Abdomen light vinaceous-fawn, the dorsum suffused except at base with deep brownish drab, laterally with dark segmental lines. Fore wing narrow, the apex acute, the termen straight, slightly curved before tornus; costal margin to near apex shell-pink; below costa, including cell, a diffuse snuff-brown shade from base, becoming fainter towards the broad subterminal shade, which is again snuff-brown at costa, this shade much fainter, more of an ecru-drab from vein 6 to inner margin; the inner margin shell-pink at base, expanding to cell and vein 5 at subterminal shade; termen narrowly shell-pink; a fine terminal dark line; cilia becoming snuff-brown according to light. Hind wing thinly scaled, white, faintly suffused with shell-pink, the inner margin with darker hairs; cilia white. Wings below thinly scaled, pale ecru-drab, the margins of fore wing and costa of hind wing seashell-pink; a faint darker subterminal shade on fore wing.

Expanse 46 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34491, U.S. N. M.

Chilo ? chabilalis, sp. n.

Female.—Antenna with the shaft white. Palpi light vinaceous-cinnamon. Head and collar dorsally white, at shoulders vinaceous-cinnamon; thorax and tegulæ white, the latter with a drab streak outwardly. Abdomen white at base, dorsally cinnamon-drab, with subdorsal white segmental lines; laterally and underneath pale greyish with white segmental lines; anal segment and legs white. Fore wing: base light orange-yellow from just below vein 1, expanding to costa antemedially, limited by a thick fuscous irregular line, outcurved below cell, obliquely outbent above median, not reaching subcostal vein, followed from above vein 1 to apex by a vinaceous-fawn space edged below by a fuscous line twice lunular from vein 1 medially to cell, then outbent, faintly dentate at lines, to termen at vein 5; all the tornal space below this line cream-white with a few black scales on interspaces; cilia chestnut; a black point at end of cell; costa finely white. Hind wing white. Wings below light buff. Fore wing with the cilia chestnut, the vinaceous-fawn space of upper surface faintly indicated.

Expanse 48 to 55 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34492, U.S. N. M.

Differs from typical *Chilo*. Conical projection on frons less acute; ocelli present, venation of fore wing as in *Chilo*; hind wing with veins 4 and 5 well stalked.

Three specimens in National Museum.

Chilo ? *aracalis*, sp. n.

Female.—Head and palpi cinnamon-buff. Thorax vinaceous-buff. Abdomen above light cinnamon-drab, underneath tilleul-buff. Fore wing light cinnamon-drab suffused with salmon-buff below cell and vein 2 to inner margin, and irrorated with fuscous scales; a black point at end of cell emitting a faint salmon-buff streak distally; very faint traces of subterminal dark points; terminal black points on interspaces; cilia sericeous-drab. Hind wing whitish buff suffused with pinkish buff. Wings below pale pinkish buff; a fine terminal dark line, cilia terminally mottled with drab on fore wing.

Expanse 60 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34490, U.S. N. M.

Erupa parnahyba, sp. n.

Female.—Head, collar, and thorax light vinaceous-buff, the palpi army-brown; abdomen with alternate buff and fuscous bands. Fore wing light vinaceous-fawn thinly irrorated with fuscous scales, the space above median vein, also the termen, suffused with wood-brown; a small black spot at end of cell; a hair-brown line from below costa beyond cell inbent to before middle of inner margin; a similar line well beyond from costa, indentate at vein 7 and less inbent to inner margin, the two lines connected at vein 7 by a dark line; terminal fuscous points on interspaces connected by a very fine dark line; tips of cilia dark shaded. Hind wing almost entirely citrine-drab with vinaceous-drab shown through the scaling on antemdial and terminal spaces; a dark point at end of cell; a broad postmedial hair-brown line; a fine dark terminal line with some fuscous lunules and points. Wings below light vinaceous-fawn, the veins from base to outer line finely hair-brown; fuscous points at end of cells; a broad hair-brown outer line; fuscous points on interspaces, those on hind wing partly linear.

Expanse 68 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34489, U.S. N. M.

Erupa olorana, sp. n.

Male.—Antenna and palpi light pinkish cinnamon. Head and collar clay-colour. Thorax and abdomen above silky army-brown, the latter with paler segmental lines; underneath vinaceous-buff. Fore wing from base to outer line avellaneous, with a fawn-colour streak in cell from base to outer line and a shorter streak above end of cell; outer line from subterminal line at costa straight to before middle of inner margin army-brown inwardly edged with tilleul-buff; outer space fawn-colour, with a subterminal tilleul-buff line from costa faintly inbent to inner margin before anal angle, preceded by fuscous points on veins and outwardly edged with army-brown; a fine vinaceous-buff line along termen; cilia avellaneous, with an army-brown line at base. The apex is acute, the termen somewhat rounded at tornus. Hind wing silky buffy brown; a terminal fine army-brown line from apex to vein 2, slightly interrupted; cilia smoke-grey. Wings below silky light cinnamon-drab; a fine subterminal dark line parallel with termen, faintly lunular.

Expanse 46 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34488, U.S. N. M.

A long series in National Museum.

EPIPASCHIINÆ.

Jocara pyropicta, sp. n.

Female.—Palpi drab-grey, the tips of joints whitish. Head pale drab-grey; collar wood-brown; thorax tilleul-buff; tegulæ almost entirely peach-red; abdomen above drab-grey irrorated with black on segments of one specimen anteriorly, forming a black line on second segment; some lateral black scaling. Abdomen below whitish, with transverse ecru-drab lines. Fore wing silvery white to postmedial line; sayal-brown and fuscous spots on costa at base, antemedially and medially the space between them with some roseate scaling; a subbasal small black spot on subcostal and a short curved line below cell; some peach-red scales at base of cell; an antemedial peach-red spot below cell preceded by a short black line to subbasal line; traces of antemedia and medial light drab lines; end of cell and beyond to postmedial line alizarine-pink, also between veins 2 and submedian from cell to postmedial; a peach-red mark on discocellular; postmedial line from below costa consisting of detached short black streaks, outcurved at vein 5, then incurved, followed by a greyish-olive shade, vertical and narrow on costal margin, expanding below vein 7 to vein 2; this again is followed by a black line, outcurved below vein 7, lunular dentate, outwardly edged with pale smoke-grey; termen light mouse-grey; terminal black spots on interspaces; cilia jasper-pink, the tips mottled with white. Hind wing white suffused with light golden-grey; termen suffused narrowly with greyish olive, expanding and darker at apex; cilia similar, with a pale line at base. Fore wing below white from below cell to inner margin, narrowly on costal margin, not reaching apex; cell outwardly and terminal space glossy hair-brown; a fine darker subterminal outcurved line, outwardly pale-edged; cilia light greyish olive with darker spots. Hind wing below white; a black point on discocellular; a postmedial punctiform line; termen deep greyish olive on interspaces from apex, narrowing to vein 2, then obsolescent.

Expanse 29 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34498, U.S. N. M.

Jocara musettalis, sp. n.

Female.—Palpi and head avellaneous. Collar, thorax, and tegulæ mouse-grey, the latter with a black streak and scaling. Abdomen above avellaneous, with fine white segmental lines, on terminal segments with black lines and shading; anal hairs cinnamon. Fore wing: basal half of costa to below cell black, then to subterminal line below vein 4, also the entire terminal space deep greyish olive; inner margin broadly white, crossed by a double medial lunular line with a few dark irrorations, from medial to subterminal line suffused with drab irrorated with black scales; terminal half of costal margin and part of termen irrorated with white; subterminal line outcurved from costa and parallel with termen, lunular dentate, white, edged on both sides with hair-brown; an interrupted terminal black line; cilia pale crossed near base by a broad hair-brown shade, outwardly by a fine line. Hind wing semihyaline-white, the outer half suffused with greyish olive, broadly darker on termen; subterminal short darker streaks on veins 2–5; cilia white, crossed by a hair-brown line near base. Fore wing below: costal margin mouse-grey irrorated with white; cell and space beyond hair-brown; inner margin broadly white; veins from cell to subterminal line black, on termen ferruginous; subterminal line as above; cilia with hair-brown mottling. Hind wing below white, with only the termen narrowly greyish olive; a diffuse outcurved subterminal line and small spot at upper angle of cell.

Expanse 30 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34496, U.S. N. M.

Jocara grenvilalis, sp. n.

Male.—Palpi vinaceous-fawn. Head and collar white with a few black scales. Thorax deep mouse-grey; tegulæ white with black marks. Abdomen pale drab-grey, slightly irrorated with black subdorsally, on terminal half with dark transverse bands also irrorated with black. Fore wing white slightly suffused with smoke-grey along costa, in and below cell, below submedian, and beyond cell to subterminal line, all thinly irrorated with dark scales; an antemedial black spot in cell and streak above vein 1; a slight black streak in cell, before a hair-brown medial line, vertical from costa, interrupted below cell, inbent, double on inner margin; a fuscous line on discocellular; subterminal line outcurved from costa, white, dentate from vein 6 to vein 3, inwardly edged with drab and black streaks on veins, outwardly with fuscous; below vein 3 incurved with diffuse dark edging; termen above vein 5 to costa pale olive-grey with black irrorations, below vein 5 to inner margin mottled with pale drab-grey and fuscous; cilia with a pale pinkish-buff line at base followed by hair-brown and white mottling. Hind wing semihyaline white with narrow terminal hair-brown suffusions, and fine dusky scaling postmedially on veins from cell; cilia at base pinkish buff, then white with hair-brown spots. Fore wing below white suffused with ecru-drab, except on inner margin; costal margin and veins from cell pinkish cinnamon; apex partly sayal-brown; faint traces of the subterminal line; cilia white, with hair-brown spots at veins. Hind wing below as above; cilia white with small hair-brown spots.

Expanse 26 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34495, U.S. N. M.

Cecidipta malrubia, sp. n.

Female.—Palpi and frons light pinkish cinnamon. Vertex, collar, and thorax sayal-brown. Abdomen above with broad fuscous and narrow sayal-brown transverse lines; light pinkish-cinnamon band at base. Fore femora light pinkish cinnamon; tibia wood-brown, the fore and mid-tibia black with white rings. Fore wing above: base pinkish cinnamon with some sayal-brown mottling; an antemedial snuff-brown line, almost vertical, adjoining a small fuscous spot in cell; a very fine and faint medial line; a small fuscous spot on discocellular, below it a vertical, macular, fuscous line to inner margin, followed at costa by a small whitish spot, preceded below cell by some silvery-white scaling; postmedial space and veins to termen pinkish cinnamon; the subterminal line whitish, outcurved between veins 5 and 2, lunular dentate, on costa and inner margin vertical, edged on either side by tawny olive; a terminal black line cut by veins; sayal-brown suffusions at costa before apex; cilia light pinkish cinnamon, partly interrupted by fuscous cilia. Hind wing fuscous; an interrupted narrow black terminal line; cilia fuscous with light tips. Wings below hair-brown, the margins suffused with russet-vinaceous; inner margin of fore wing and basal half of hind wing below costa whitish.

Expanse 25 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—Cat. No. 34505, U.S. N. M.

Cecidipta elphegealis, sp. n.

Female.—Palpi buffy brown, the fringe below tipped with fuscous. Head, collar, and tegulæ wood-brown. Abdomen above avellaneous, with broad black transverse lines; underneath white. Fore wing above: a black spot at base of costa, then white from costa to median beyond middle of cell, with a few black scales; inner margin broadly light wood-brown with some white and black scales below cell antemedially; a very irregular fine black medial line, followed by a broader black broken line, finer and double below vein 2, filled in with silvery scaling, the inner line inangled on vein 1; a fuscous vertical shade beyond, expanding basad between veins 5 and 2, closely followed by a fine fuscous outcurved dentate line, outwardly edged with white; small white spots on costa medially and postmedially; termen broadly whitish irrorated with vinaceous-fawn, and with black points on veins; small terminal black spots on interspaces; cilia with light cinnamon spots and a transverse line before tips. Hind wing light greyish olive, the veins, postmedial line, and inner margin hair-brown; a black spot above postmedial line at vein 2, cilia greyish olive with white tips. Fore wing below hair-brown, paler on termen; costa whitish, with a subterminal small white spot; inner margin broadly white; a terminal black line interrupted by veins. Hind wing below paler; a black point at upper angle of cell; the fine postmedial line distinctly dentate.

Expanse 30 mm.

Habitat.—Sta. Catharina, Brazil.

Type.—Cat. No. 34506, U.S. N. M.

Chloropaschia celsusalis, sp. n.

Male.—Palpi pale drab-grey. Head, collar, and tegulæ drab-grey, the thorax darker. Metathorax white edged below by a fine, curved, black line, the lateral tufts silvery pale drab-grey tipped with silvery white. Abdomen above drab-grey, the anal hairs white; legs largely white and greyish olive, the fore tibia streaked above with black. Fore wing above: basal half greyish olive limited by a fine black line outcurved to vein 1, then outbent to inner margin; subbasal and antemedial series of irregular black spots; outer half of wing white, with a fine dark lunule on discocellular and below vein 3; lunules followed by a few light greyish-olive irrorations; subterminal line fine, dark on costa, slightly excurved to vein 6, paler, wavily inbent to vein 3, then darker and excurved; some marginal greyish-olive irrorations; a fine black interrupted terminal line; cilia white crossed by some greyish-olive scaling. Hind wing silvery light-drab, with darker suffusions on termen. Fore wing below silvery greyish olive; an oblique whitish spot at middle of costa; a subterminal black streak on costa with white scaling on either side. Hind wing below silvery white; veins 3 to 5, also termen, deep greyish olive, veins 6–8 with short subterminal streaks.

Expanse 29 mm.

Habitat.—Province of Rio de Janeiro.

Type.—Cat. No. 34507, U.S. N. M.

Two specimens in National Museum.

Chloropaschia macallalis, sp. n.

Male.—Antenna ciliated without tuft at base. Palpi upturned, reaching above head, the third joint long, acute, light buff, some dark scales on third joint. Head, collar laterally, and tips of tegulæ yellow-ochre; thorax, collar medially, and tegulæ white. Abdomen above white with light greyish-olive transverse bands, the last two segments dorsally buckthorn-borwn, subdorsally fuscous, the anal hairs yellow-ochre; abdomen below buckthorn-brown with a white ventral line at base. Fore wing to outer line white suffused and irrorated with light ochraceous buff; some black scales on inner margin, an antemedial fuscous spot below cell on a faint outcurved dark line from base of costa, and similar diffuse spots on costa and inner margin before middle of wing; a medial black point in cell, followed by a larger black spot; postmedial line remote, black, oblique from costa to vein 5, shortly outcurved and inbent, dentate to vein 2, inbent then vertical to inner margin, rather diffuse; terminal space largely suffused with Prout's brown, with pale shading below vein 4; a thick terminal black line interrupted by veins; cilia white with some dark spots. Hind wing semihyaline, iridescent white; apex narrowly black, below vein 4 to anal angle a narrow buckthorn-brown line; cilia white, above vein 4 to apex with dark spots and suffusion at apex. Fore wing below white; cell before middle fuscous; apex broadly hair-brown; below vein 4 the termen suffused with drab.

Expanse 31 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Types.—Cat. No. 34497, U.S. N. M.

Chloropaschia nadena, sp. n.

Male.—Palpi rufous edged with fuscous below; a white spot on second joint. Head, thorax, and anal tufts light pinkish cinnamon, the tegulæ dorsally fringed with cinnamon hairs. Abdomen light drab, the third and fourth segments darker; traces of dark segmental lines. Fore wing largely buff edged by an oblique whitish line from beyond middle of costa to termen at vein 4, also along inner margin; some diffuse pinkish-cinnamon suffusions in cell, the median outwardly and base of veins 3 and 4 cinnamon; a Mikado-brown and black streak along costa medially; a few dark scales in middle and end of cell; apex broadly mouse-grey, crossed by the subterminal dentate fuscous line, outwardly edged with smoke-grey to vein 4, below vein 4 the line is white, sinuous, outwardly dark-edged from vein 2 to inner margin; some fuscous and cinnamon scaling above the white inner margin; a fine terminal white line; cilia pale pinkish buff interrupted by black spots at veins. Hind wing semihyaline white, the termen hair-brown, expanding at apex. Fore wing below buffy brown, suffused with hair-brown, the costa cinnamon-buff with some fuscous streaks along costal edge, the inner margin white; a postmedial dentate black line from costa to vein 4 somewhat interrupted between veins 4 and 2; terminal dark shading at apex and inner angle. Hind wing below with the costa suffused with pinkish cinnamon; terminal dark suffusions narrower than above.

Expanse 25 mm.

Habitat.—São Paulo de Olivença, Amazons.

Type.—Cat. No. 34485, U.S. N. M.

Chloropaschia godrica, sp. n.

Male.—Palpi avellaneous. Collar wood-brown with army-brown scaling dorsally. Tegulæ drab. Abdomen above dark mouse-grey, the posterior portion of segments light greyish olive. Fore wing: base suffused with vinaceous-buff from within cell to inner margin, with a few dark irrorations, the costa wood-brown; an antemedial black point in cell and a sinuous, interrupted, black line from below cell; a black line at discocellular closely followed by a thick lunular citrine-drab line outwardly finely edged with silvery-grey scaling and then by a black line sinuous to vein 2, then inbent and inangled below fold; space beyond broadly vinaceous-buff, somewhat silvery, with a few black scales on veins 2 and 3; subterminal line from vein 6 to below vein 4, outcurved, thick, and lunular dentate, then finer, sinuous, incurved below vein 2, outwardly edged with white, more broadly from below vein 2, and then by buffy-brown; termen mottled with silvery grey; a terminal thick black line, with white points at veins; cilia white, shaded with wood-brown and with dark spots. Hind wing semihyaline smoky white, the termen suffused with hair-brown; cilia white, with dark spots and similar shading between them. Fore wing below hair-brown, the inner margin narrowly white, the costa avellaneous at base, then army-brown to apex; postmedial fuscous shading from vein 8 to vein 4, with a fuscous erect line above vein 8. Hind wing below smoky white, the termen hair-brown, only slightly broader at apex; costa suffused with vinaceous-fawn.

Expanse 28 mm.

Habitat.—Victoria, Amazons.

Type.—No. 34486, U.S. N. M.

Chloropaschia lascerianalis, sp. n.

Male.—Palpi with first and second joints black, the third tilleul-buff. Head and collar pale pinkish buff, the latter tipped with black. Thorax avellaneous mottled with dark scales. Abdomen above light greyish olive, underneath white; anal hairs cinnamon. Fore wing above: basal half pinkish buff, in places suffused with pinkish cinnamon and irrorated with black scales between the veins; a black lunular subbasal line; an antemedial black mark in cell and streaks on median and submedian veins; interrupted medial black markings, closely followed by a black spot on discocellular, from which a black line is outbent and interrupted to near inner margin; postmedial space whitish except a large spot at apex, and partly irrorated with pale tawny-olive scales; beyond discal mark a fine line consisting of black scales is outbent from costa, incurved from vein 5 to vein 3, again incurved, crossing the medial line; apical spot tawny olive, darker towards apex, the veins terminally with thick fuscous streaks; a tawny-olive subterminal line extends from vein 5 to inner margin; a terminal black line interrupted from vein 5 to tornus by white; cilia tawny olive, with black spots and clusters of hairs at veins. Hind wing semihyaline buffish white; veins terminally hair-brown; termen narrowly suffused with hair-brown, expanding slightly at apex. Fore wing below hair-brown, darker in cell and on termen; suffused with cinnamon according to light; costa cinnamon-buff; inner margin white. Hind wing below white; a small hair-brown spot on discocellular; apex narrowly hair-brown; costal margin light pinkish cinnamon.

Expanse 23 mm.

Habitat.—São Paulo de Olivença, Amazons.

Type.—Cat. No. 34487, U.S. N. M.

Macalla ineldolis, sp. n.

Male.—Antenna pectinated with cilia to beyond middle. Palpi cinnamon. Head, collar, and tegulæ light vinaceous-cinnamon, the tufts behind antenna verona-brown; abdomen above buffy brown with pale segmental lines; anal tuft light vinaceous-cinnamon; underneath avellaneous. Fore wing from base of costa to a white postmedial line pinkish buff, expanding to within end of cell, the space below cell to inner margin sayal-brown, partly paler shaded; a black streak below median from base to middle of cell; a thick fuscous streak at middle of costa; postmedial line finely edged on either side by diffuse orange-cinnamon scaling, also at costa preceded by some short fuscous streaks; terminal space mouse-grey crossed by a wavy iron-grey fascia outwardly edged by a short white line on costa; an outcurved series of minute pinkish-buff streaks, preceded by short black lines on veins; a terminal black line, interrupted by short whitish streaks on veins; cilia pale smoky-grey, with fuscous spots at veins. Hind wing semihyaline-white, the termen narrowly suffused with hair-brown, expanding at apex; the veins on outer half finely drab, with darker subterminal streaks. Fore wing below pinkish buff on basal half, the outer half light cinnamon-drab; a subterminal fine fuscous line, outcurved at costa, outwardly pale-edged; conspicuous black spots on cilia. Hind wing below white; costa vinaceous-fawn; termen as above; a small fuscous spot at upper angle of discocellular. The subterminal dark streaks on hind wing better defined. Female with all the shades slightly darker.

Expanse, male 30 mm., female 35 mm.

Habitat.—Campo Bello, Province of Rio de Janeiro.

Type.—No. 34494, U.S. N. M.

IX.—*Three Helminthological Notes.* By H. A. BAYLIS, M.A., D.Sc., Department of Zoology, British Museum (Natural History).

1. THE NEMATODE GENERA *CYSTIDICOLA*, *METABRONEMA*, AND *CYSTIDICOLOIDES*.

While studying material from the helminthological collection of the School of Public Health and Tropical Medicine, Sydney, the writer has come across some specimens which have been determined as *Metabronema magnum* (Taylor, 1925). These were obtained from the swim-bladder of a "yellowfish" (*Caranx* [*Gnathanodon*] *speciosus*) at Cleveland Bay, Queensland. *M. magnum* was originally recorded, under the name of *Habronema magna*, from *Trachurus declivis* and *Sparus* sp., also in Australia.

The opportunity has been taken of comparing the genus *Metabronema* Yorke and Maplestone, 1926, with *Cystidicola*, to which, in the writer's opinion, it is much more closely related than to *Habronema*. The only difference which seems to be of possible generic value lies in the arrangement of the caudal papillæ of the male *. In *Cystidicola* the preanal papillæ are arranged in two double series, while in *Metabronema* there are two series of four simple papillæ each. The same character has been used by Skinker (1931) to differentiate the genus *Cystidicoloides* from *Cystidicola*. *Cystidicoloides fischeri* (Travassos, Artigas, and Pereira, 1928) and *C. harwoodi* (Chandler, 1931) are the two species attributed by Skinker to this genus. On comparing the descriptions of these forms with *Metabronema magnum*, almost the only morphological difference appears to be in the position of the vulva, which is said to be behind the middle of the body in *Cystidicoloides*, while in *Metabronema* it is at about the anterior third. The two species of *Cystidicoloides* are said to inhabit the stomach and not the swim-bladder of their hosts. These differences seem scarcely sufficient to warrant the separation of the genera, and accordingly the writer regards *Cystidicoloides* as a synonym of *Metabronema*. This necessitates changing the names of the two species of the former to *Metabronema fischeri* and *Metabronema harwoodi*.

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* Taylor describes and figures a gubernaculum in *M. magnum*, but the writer has not been able to confirm the presence of this structure.

A question which has troubled the writer for some time is whether the trout (*Salmo trutta*), more especially in Great Britain, actually harbours two species of *Cystidicola* or only a single species. According to v. Linstow (1909) "*Ancyracanthus cystidicola*" (now called *Cystidicola farionis* Fischer, 1798) and "*Ancyracanthus*" *impar* both occur in the swim-bladder of "*Trutta fario*." The principal differences between these two species mentioned by v. Linstow may be tabulated as follows :—

	cystidicola.	*impar.*
Length, ♂	19–22 mm.	12·1 mm
,, ♀	30–33 mm.	23 mm.
Number of pairs of double pre-anal papillæ of ♂	10	7
Number of pairs of postanal papillæ of ♂	4	5
Length of longer spicule	0·52 mm.	0·75 mm.
Position of vulva	In middle of body.	At anterior third of body.

Now Schneider (1866), who was the original describer of *A. impar*, records it only from the smelt (*Osmerus eperlanus*), and not from the trout, and at the same time gives a description of *A. cystidicola* from *Salmo fario*. He gives the length of *A. impar* as 15 mm. in the male and 31 mm. in the female, and that of *A. cystidicola* as 10 mm. in the male and 11–34 mm. in the female. Leiper (1908), in describing *Cystidicola farionis* from trout in Great Britain, gives the length of the male as "about 14 mm." and that of the female as 22–26 mm. Dujardin (1845) gives, for "*Dispharagus cystidicola*" from *Salmo fario*, male 10·5–21·5 mm., female 18–20 mm. It is fairly clear, therefore, that if the species are distinct both must be very variable in size, and their dimensions are valueless as a specific character.

As regards the postanal papillæ of the male, v. Linstow appears to have taken his data from Schneider, but the latter says, concerning *A. impar*, that he found on one side 16 preanal papillæ, arranged in pairs, and on the other not more than 12 or 13 papillæ, also in pairs. He adds, moreover, that although he has compared a large number of specimens he is still not entirely certain of the arrangement of the papillæ. Leiper states that in *Cystidicola farionis* there are nine pairs of preanal papillæ and five single postanal papillæ on each side. These are also the numbers figured by Yorke and Maplestone (1926) for *C. farionis*.

As regards the length of the longer (left) spicule, v. Linstow's measurement (0·52 mm.) for " *A. cystidicola* " seems to have been taken from Dujardin. Leiper gives 0·75 mm. for *C. farionis*, which is precisely the measurement given by v. Linstow for *A. impar*. As to the position of the vulva, v. Linstow was probably again quoting Schneider. The latter states that in *A. cystidicola* the vulva is "shortly behind the middle," while in *A. impar* it is at 11 mm. from the anterior end (*sc.* in a specimen 31 mm. long). Dujardin says that in *Dispharagus cystidicola* the vulva is a little in front of the middle.

The writer has frequently had occasion to determine specimens of *Cystidicola* from trout in Great Britain, and formerly thought it possible to recognize two species. On re-examination, however, it appears that even those which were previously determined as *C. farionis* conform rather to v. Linstow's conception of *C. impar*, except as regards the position of the vulva, which is approximately in the middle of the body. No male specimens have been seen with less than five pairs of postanal papillæ. The preanal papillæ seem to vary between six and ten pairs on either side, while the left spicule, in mature specimens, is always over 0·7 mm. long. From Leiper's description it is evident that he was dealing with similar specimens. There seem, in fact, to be strong grounds for suspecting that *C. impar* (Schneider) is merely a synonym of *C. farionis*, and that only a single, variable species occurs in the trout in this country. This, on the ground of priority, should be called *C. farionis*, although the original description by Fischer does not enable his species to be recognized. Material from *Osmerus* is not available for comparison, and it is, of course, possible that specimens found in that host may prove to be distinct from those in the trout.

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2. *OXYSPIRURA PARVOVUM* SWEET, 1910, A SYNONYM OF *OXYSPIRURA MANSONI* (COBBOLD, 1879).

The Australian collection already mentioned includes a number of specimens from the eyes of a Muscovy duck (*Cairina moschata*), collected at Townsville by Mr. J. W. Fielding, which are referred to *O. mansoni*. Fielding (1926) has recorded the occurrence of "eye-worms" in the Muscovy duck as well as in fowls in North Queensland, and, in the course of his researches on the life-history of the worm, used the Muscovy duck with success as a subject for experimental infection.

There has been considerable doubt as to whether the Australian form originally described by Sweet (1910) under the name of *Oxyspirura parvovum* is specifically distinct from *O. mansoni*, the classical description of which was given by Ransom (1904). Fielding appears at first (1926) to have been inclined to assign his specimens to *O. parvovum*, since he remarks that "until a comparison of a long series of this species and Cobbold's *Oxyspirura* *mansoni* has been made it is advisable to allow the Australian species to stand as at present." Later, however (1928), he examined " a great amount of material, both American and Australian," and, although he does not make any definite statement as to the synonymy, it seems clear that he found no morphological differences important enough to suggest that he was dealing with two distinct species.

The criterion chiefly relied upon by Sweet in distinguishing the Australian species seems to have been the size of the eggs, which she found to be 0·033–0·045 × 0·025–0·03 mm., as against the much larger size (0·05–0·065 × 0·04–0·045 mm.) given by Ransom. Fielding, however, found that the average size of the eggs in American material was 0·043 × 0·031 mm., which was only very slightly larger than the average in Australian material (0·041 × 0·03 mm.). Smit (quoted by Cram, 1927) gives 0·04 × 0·02 mm. for *O. mansoni*. The writer has obtained the following measurements for mature eggs in the material from *Cairina* :—0·042–0·048 × 0·028–0·032 mm. In material from a fowl, collected in the Federated Malay States, the mature eggs were found to measure 0·04–0·048 × 0·026–0·028 mm. No other observer seems to have obtained measurements as large as those of Ransom.

Another difference between Sweet's description and that of Ransom is in the number of caudal papillæ in the male. Ransom figures four pairs of preanal and three pairs of postanal papillæ, while Sweet found only three pairs of preanal and two pairs of postanal. In the Australian and Malayan specimens examined by the writer the papillæ were found to be as figured by Ransom. The most posterior pair of " preanal " papillæ is laterally situated and adanal in position, while the third postanal pair consists of very small papillæ near the tip of the tail. Sweet seems to have been unable to detect the adanal pair, and Fielding (who figures it) saw it only in two or three out of a large number of specimens. Both these authors figure only lateral views, and these papillæ are not easy to see except in a ventral view, when they become quite conspicuous.

As regards the structure of the head, Sweet states that in her material the six-lobed chitinous ring surrounding the mouth, described by Ransom, was absent. The writer finds that a six-lobed rosette-like structure is present in an apical view of the head in an Australian specimen, having exactly the appearance figured by Ransom. This structure, however, lies below the cuticle, and does not appear to be composed of cuticular or chitinoid material. The cuticular "wings" at the sides of the head, stated by Sweet to be "sometimes" present in the male, were not seen in the writer's specimens, and, indeed, from Sweet's description, it appears probable that these were artifacts, due to the separation of the cuticle from the subcuticular tissues.

In view of the points considered above, the writer feels justified in concluding that the evidence for the existence of a distinct Australian "eye-worm" of poultry is unsatisfactory, and regards *O. parvovum* Sweet as a synonym of *O. mansoni.*

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3. THE HOST OF *HETERORCHIS CRUMENIFER* BAYLIS, 1915.

This curious Trematode was originally recorded * as a parasite of *Protopterus æthiopicus*, the animal usually known as the African mudfish or lungfish. Prof. G. D. Hale Carpenter, who collected the material, now informs me that the determination of the host was erroneous, and was due to a confusion between two Luganda native names, "Mălĕ" and "Mamba." The latter name, though also used by Swahili-speaking natives in Uganda for crocodile, is applied to *Protopterus*, but the "Mălĕ," from which *Heterorchis* was obtained, is a Silurid fish. Mr. J. R. Norman has kindly drawn my attention to a report by Mr. Michael Graham * in which "Male" is given as one of the Luganda names of *Clarias mossambicus*, and the English name of the same species is given as "Mud-fish" or "Cat-fish." It seems, therefore, that the real host of *Heterorchis* is probably *Clarias mossambicus* or a closely-related fish.

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* Ann. & Mag. Nat. Hist. (8) xvi. p. 85.

X.—*The African Species of* Cylindromyia *Meigen* (*Diptera*, Tachinidæ). By C. H. Curran, American Museum of Natural History, New York.

[Plates I. & II.]

Up to the present time a dozen African species of *Cylindromyia* have been described, but no comprehensive review has been published. The material before me contains seven undescribed species, and further collecting will undoubtedly result in the discovery of additional forms. While most of the species may be easily recognized, a few are very similar and can only be distinguished with any degree of certainty by the examination of the genitalia. There is some variation in the colour of the abdomen, and as a result some confusion may result from any attempt to identify the species by means of the key.

Cylindromyia was established by Meigen in 1802†, with *Musca brassicaria* Fabricius as the sole species. In 1805 Latreille‡ proposed the genus *Ocyptera*, and *M. brassicaria* was named as the type by Curtis in 1837. *Ocypterula* Rondani differs from *Cylindromyia* in having only a single sternopleural bristle, but I do not think the character is of importance, and it seems best to consider the name a synonym despite certain differences in structure and chætotaxy. As a general rule, there is an appendage at the bend of the fourth vein, but this may be absent and the bend rounded (see *atypica* and *ugandana*) or absent with the bend angular. The antennæ may be quite long or rather short, and the propleura may be haired or bare in the middle. Aldrich * has reviewed the Nearctic species, and includes an excellent history of the genus.

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* 'The Victoria Nyanza and its Fisheries': published by the Crown Agents for the Colonies, 1929.

† Illiger's Mag. ii. p. 279.

‡ Hist. Nat. Crust. et Ins. xiv. p. 378.

While I have illustrated all the species available, it must be remembered that only one sex is known of a number of the species, and it may be found that the females of some of the forms are so similar that they will be separated with great difficulty. Some of the described species remain unidentified, and it may be that they are the same as some of the species included in this contribution, although the descriptions would indicate otherwise.

The species of *Cylindromyia* are parasitic on bugs of the family Pentatomidæ, and there is some evidence that they also attack representatives of the family Acrididæ.

Table of Species.

1.	A single sternopleural bristle; apical cell rounded behind	22.
	Two sternopleural bristles; bend of fourth vein rounded or angulate	2.
2.	Bend of fourth vein at almost a right angle and usually with an appendage	6.
	Bend of fourth vein broadly rounded and never with appendage	3.
3.	First abdominal segment strongly constricted in the middle; brownish species	*pedunculata* Curran.
	First abdominal segment not constricted	4.
4.	Three postsutural dorsocentral bristles; marginals on first abdominal segment	5.
	Two postsutural dorsocentrals; a pair of discals near the middle of the first abdominal segment and no marginals	*flavibasis* Villeneuve.
5.	Fourth abdominal segment black; genitalia as in fig. 2 (Pl. I.)	*ethelia*, sp. n.
	Fourth abdominal segment reddish; genitalia as in fig. 3 (Pl. I.)	*completa* Curran.
6.	Propleura bare on median portion	7.
	Median portion of propleura with at least one or two setæ	19.
7.	Legs wholly black, the femora rarely reddish below	16.
	At least the anterior four femora reddish	8.
8.	Almost the anterior half of the wing brown, or the first abdominal segment without marginals	9.

Proc. U.S. N. M. lxviii. Art. 23 (1926).

Wings yellowish or luteous on the basal half in front, with brown preapical cloud; first abdominal segment with marginals. (Congo.)................ *eronis* Curran.

9. Abdomen wholly black or the scutellum with two or three pairs of marginals... 10.

Each segment mostly reddish on the sides and venter; only a single pair of strong scutellars .... *lavinia*, sp. n.

10. Abdomen practically all black, the incisures more or less reddish laterally... 11.

Abdomen with very evident reddish markings dorsally .... 13.

11. Mesonotum, from posterior view, with an incomplete black fascia immediately behind the suture .... 12.

Mesonotum without such fascia, almost unicolorous, the vittæ fairly distinct. (Uganda.)......................... *nigra* Villeneuve.

12. Female genitalia without an excision preceding the hooks; ♂ unknown. (Similar to *soror* Wied., Pl. II. fig. 17.). *snelli*, sp. n.

Female genitalia with deep excision preceding the hooks (Pl. II. fig. 16) ..... *nigra* Villeneuve.

13. First abdominal segment without marginals; wings more or less luteous in front, the costal cell brown basally; scutellum reddish .... *incerta*, sp. n.

First abdominal segment with strong marginals .... 14.

14. Abdomen black or with a median black vitta.............................. 15.

Apical half of the first and whole of second abdominal segment reddish .... *sensua*, sp. n.

15. Scutellum and sides of the mesonotum reddish; pleura black .... *marginalis* Wiedemann.

Scutellum black; humeri usually partly reddish .... *soror* Wiedemann.

16. Abdomen largely reddish yellow......... 17.

Abdomen wholly blackish or nearly so ... 18.

17. Mesonotum very densely white pollinose, with two very broad black vittæ; antennæ mostly pale reddish yellow, short; wings not yellow on basal third in front; oral vibrissæ long and strong. *oxyphora* Villeneuve.

Thorax rather evenly thinly pollinose, the dark vittæ rather obscure; antennæ blackish; wings broadly yellow basally. *xiphias* Bezzi.

18. Two pairs of scutellars, the basal pair extremely weak or absent .... *soror* Wiedemann.

Three pairs of scutellars............... *atrata* Fabricius.

19. Abdomen of normal shape; parafacials wholly pollinose; wings broadly yellowish on basal half in front, with a brown preapical cloud .... 20.

Abdomen constricted on the first segment; parafacials bare on the inner upper half; anterior half of wings brownish.. *insolitum* Curran.

20.	Abdomen reddish dorsally except the base and sides	21.
	Abdomen with dorsal black vitta or largely black above	*euprepia* Speiser.
21.	Sides and median pollinose stripe on thorax golden............................	**picta* Walker.
	Sides and median pollinose stripes on thorax white	**pictipennis* Macquart.
22.	Abdomen wholly black	*ugandana*, sp. n.
	Abdomen reddish on subbasal half	*atypica*, sp. n.

Cylindromyia pedunculata Curran.

Curran, 1927, Amer. Mus. Novit. no. 248, p. 3.

Legs reddish brown or reddish ferruginous, thinly greyish pollinose; apices of femora and the trochanters reddish; wings brown, hyaline behind the fifth vein and along the posterior margin beyond the apical and discal cells, the discal cell with a yellowish hyaline longitudinal stripe.

Length 12 mm.

Female.—Head blackish; an inner stripe on the parafacials, the oral cavity, and the antennæ, dull wine-reddish, tinged with brown. Head yellowish-grey pollinose, except the broad brownish frontal vitta and an opaque brown spot outside the vibrissal angles; facial carina prominent, obsolete on the lowest fourth. Frontal vitta four or five times as wide as either parafrontal, narrowed above; four or five pairs of weak cruciate frontals; two weak orbitals (ocellars and verticals broken off). Occiput pale-haired below the neck, elsewhere with short bristly hairs, the cheeks with similar but slightly longer hair. Third antennal segment hardly twice as long as the second, the antennæ reaching practically to the oral margin; arista brown, the basal fourth luteous.

Thorax brownish black, the humeri and scutellum reddish brown, the mesonotum with a pair of narrow, broadly separated, obscure darker vittæ in front of the suture. No acrostichal bristles; dorsocentrals 1—3, two of the latter weak; three pairs of marginal scutellars, the apical pair cruciate; sternopleurals 1—1. Median portion of propleura bare.

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* These may all be forms of the same species. I have no specimens agreeing with the last two, so follow the descriptions. There may be genitalic differences—the two sexes are rather differently coloured in what I take to be *euprepia* Speiser.

Squamæ rather small, cinereous, with brown border. Halteres luteous, with brown knob.

Abdomen brownish black, with obscure reddish tinge in places, the apex of the first segment greyish pollinose, the segment elsewhere thinly so, strongly constricted behind the middle. First to third segments each with a pair of strong marginals, the basal portion of the first (actually the first segment) with three or four moderately strong laterals, beyond which there is a strong lateral and also a strong marginal lateral. Apex of the genitalia reddish, the apical portion with a long, finger-like, basal process directed toward the abdomen.

Female, Stanleyville, March 1915. Type in the American Museum of Natural History.

Cylindromyia flavibasis Villeneuve.
(Pl. I. fig. 1.)

Ocyptera flavibasis Villeneuve, Ann. S. Afr. Mus. xv. p. 506 (1916).

Wing brownish, with paler posterior border and broadly yellowish base.

Length 11 mm.

Male.—Head silvery-white pollinose except the upper part of the occiput and the brownish-black frontal vitta. Occiput and posterior half of the cheeks with yellowish-white hair, the cheeks with black hair in front. Antennæ short, dull black, the basal third of the arista brownish red.

Thorax black, the pleura thickly shining white pollinose, the mesonotum with thin whitish pollen, the vittæ moderately distinct in front of the suture. Dorsocentrals strong, 3—2; scutellum with one pair of strong and two pairs of weak marginals; propleura bare.

Legs black, the coxæ white pollinose; pulvilli elongate, brown.

Wings brown, somewhat paler posteriorly, the base very broadly yellowish. Squamæ white, with yellow rim. Halteres yellow.

Abdomen pale orange and black. Base of the abdomen rather narrowly brown; second segment wholly orange, with the broad apex brown on the dorsum, the third with about the apical fourth black, the fifth segment and genitalia black. Bases of the second and third segments narrowly white pollinose except laterally, the fourth white pollinose on the basal two-thirds except for a median vitta. Genital forceps rather reddish, lateral view as in fig. 1 (Pl. I.).

Two males, Pretoria, S. Africa, 18. xii. 1915 and 29. i. 1916 (*H. K. Munro*).

The presence of only two postsutural dorsocentrals will distinguish this species from its allies.

Cylindromyia ethelia, sp. n.

(Pl. I. fig. 2.)

Mesonotum white pollinose, with two broad black vittæ; wings yellow basally; abdomen mostly reddish.

Length 8 mm.

Male.—Head silvery-white pollinose, the parafrontals rather golden-yellow but becoming dark greyish above. Frontal vitta black, with a subshining brown V extending forward from the ocellar triangle. Occiput with white hair, the upper third with coarse, black, bristly hair. Hair of the cheeks mostly white, a single row of black or brown bristles anteriorly. Vibrissæ long and strong. Antennæ black, the third segment moderately short and broad; arista reddish on the basal half.

Thorax with white pollen, the mesonotum with a pair of broad incomplete black vittæ. Dorsocentrals 3—3; scutellum very thinly white pollinose, with two pairs of marginals, the apical pair cruciate.

Legs black, the coxæ white pollinose; middle femora with two anterior bristles near the middle.

Wings brown, becoming grey behind, the basal fourth yellowish; bend of fourth vein rounded, without trace of appendage, the apical cell very short, petiolate.

Abdomen reddish, the broad base and an incomplete median vitta on the first segment and the fourth segment and genitalia, black; third segment with the apex broadly tinged with brownish. First and second segments each with a pair of marginals, the third and fourth each with a row. Narrow bases of the second and third segments and most of the fourth white pollinose. Fig. 2 (Pl. I.) shows lateral view of the male genitalia.

Holotype, male, Kampala, Uganda, 20. iii. 1918 (*C. C. Gowdey*), in British Museum (Natural History).

This species is apparently very similar to *oxyphora* Villeneuve, but is distinguished by having the bases of the wings broadly yellowish.

Cylindromyia completa Curran.

(Pl. I. fig. 3.)

Curran, 1927, Amer. Mus. Novit. no. 248, p. 3.

Coloured almost as in *C. flavibasis* Villeneuve, from which it is at once distinguished by the presence of three instead of two posterior dorsocentral bristles and four anterior dorsocentrals. The pair of marginal bristles are much closer to the apex of the second abdominal segment than in *flavibasis.*

Length 10 mm.

Male.—Head black, silvery-white pollinose, the occiput more greyish; hair white, fine, the black occipital bristles descending to the middle of the eyes; oral margin in front with black bristles, the oral vibrissæ long, fairly robust, cruciate; frontal bristles long, fine; ocellars long and slender; the strong verticals are reclinate. Frontal vitta opaque brown except for a shining black triangle in front of the ocelli, three times as wide as either parafrontal. Antennæ brown, three-fifths as long as the face, the arista reddish on the swollen basal fourth.

Thorax black, greyish-white pollinose, the mesonotum with brownish tinged pollen except laterally. Sternopleurals 1—1; 2 pairs of marginal scutellars, the apical pair weak and cruciate, the usual basal pair represented by one or two bristly hairs. The thorax is more bristly and more hairy than usual.

Legs black, thinly brownish-grey pollinose; pulvilli fuscous.

Wings wholly fuscous except the yellowish base; petiole of the apical cell very short. Squamæ whitish, with yellow border. Halteres yellow.

Abdomen rusty yellowish red, the base black; fourth segment darkened apically. The second and following segments each with the moderately broad base silvery-white pollinose. First and second segments each with strong marginals, the former with a row of three laterals, below the anterior of which are two or three finer ones, the second segment with a single apical lateral; third segment with a row of marginals, the fourth with a row of six. Lateral view of male genitalia, fig. 3 (Pl. I.).

Male, Faradje, Congo, xi. 1912. Type in the American Museum of Natural History.

Dr. Villeneuve labelled this as a variety of *flavibasis* Villeneuve, but on account of the unusually well-developed thoracic bristles, different genitalia, etc. it is quite evidently a distinct species. In *flavibasis* the marginals on the second segment are situated practically at the middle of the segment, while in *completa* they are near the apical fourth.

Cylindromyia eronis Curran.
(Pl. I. fig. 10; Pl. II. fig. 20.)

Curran, 1927, Amer. Mus. Novit. no. 248, p. 3.

Legs wine-reddish; wings luteous, with the broad posterior border hyaline and a large apical brown cloud.

Length 14 mm.

Female.—Head reddish yellow, shining; narrow frontal orbits, lateral half of parafacials, and the broad posterior orbits on the lower half silvery white; cheeks on upper half extending to the vibrissal angles and the occiput except below covered with obscure yellowish pollen. Facial carina obsolete on lowest third; about eight pairs of fine converging frontals; ocellars moderately strong; verticals strong, reclinate; occipital bristles sparse, reaching to about the middle of the eyes. The fine hair of the head is whitish; cheeks with black bristly hair on the anterior half. Oral vibrissæ absent, the bristles below the vibrissal angles quite weak. Antennæ rusty reddish, reaching to the oral angle, the third segment slightly over twice as long as the second; arista ferruginous, the basal fifth reddish yellow.

Thorax wine-red, the mesonotum except the broad lateral margins blackish; sternopleura and mesopleura with large blackish spot; the whole thorax thinly grey pollinose. Dorsocentrals 3—3; inner posthumeral present; three pairs of marginal scutellars, the apical pair cruciate; sternopleurals 1—1.

Legs wine-red, the tarsi black.

Petiole of the apical cell moderately long. Squamæ large, whitish, with pale yellow border. Halteres rusty reddish, with brown knob.

Abdomen blackish, with the bases of the segments, a very broad lateral stripe (the first segment on the sides except basally), and the fourth segment and genitalia wine-reddish, the bases of the second and third segments rather narrowly whitish pollinose. First segment without marginals, the second with a rather weak pair, the third with row of eight and three on the ventral corners, the fourth segment with marginals except dorsally. First segment with two subbasal laterals and an apical one, the second segment with only the apicals. Genital hooks strong, long, curved, shining black, fig. 20 (Pl. II.).

The male agrees except sexually.

Female, Stanleyville, Congo, iii. 1915; male and female, Mt. Mlanje, Nyasaland, 1. xii. 1913 (*S. A. Neave*). The type is in the American Museum of Natural History.

Cylindromyia lavinia, sp. n.
(Pl. II. fig. 21.)

Sides of abdomen reddish; wing veins broadly clouded with brown.

Length 8·5 mm.

Female.—Head silvery-white pollinose; frontal vitta brown. Antennæ reddish, the third segment brown above and apically, one-third longer than the second; arista reddish.

Thorax moderately cinereous pollinose, the median dark vittæ distinct. No acrostichals; dorsocentrals 3—3; sternopleurals 1—1; one pair of marginal scutellars.

Legs reddish, anterior tibiæ brown; tarsi black.

Wings cinereous hyaline, the veins on the anterior half broadly clouded with brown. Squamæ white. Halteres reddish, with brown knob.

Abdomen black, each segment with a very large reddish spot on the side, those on the apical segments occupying most of the segment. Lateral view of ♀ genitalia, fig. 21 (Pl. II.). First abdominal segment without marginals.

Type, female, Woodbush, S. Africa, 14. iv. 1924 (*J. C. Faure*), in Munro Collection.

Cylindromyia snelli, sp. n.

Black, the antennæ and legs reddish; tarsi black.

Length 8 mm.

Female.—Head silvery-white pollinose; frontal vitta brown; antennæ reddish, the third segment brown above and apically; arista black on apical half. Oral vibrissæ weak.

Thorax thinly greyish pollinose, from posterior view with four vittæ in front and a broad incomplete black fascia immediately behind the suture. No acrostichals; dorsocentrals 3—3; sternopleurals 1—1; three pairs of marginal scutellars.

Wings brown on anterior half, cinereous hyaline, and with yellow veins behind. Squamæ white. Halteres reddish, with brown knob.

About the basal half of second and third abdominal segments whitish pollinose. First segment with pair of submarginals. (The female genitalia are almost the same as in *soror* Wiedemann, Pl. II. fig. 17.)

Type, female, near Mazi Moja, Zanzibar, 20. viii.–11. ix. 1923 (*H. J. Snell*), in British Museum of Natural History.

This species may prove to be the same as *soror*, despite the more curved genital hooks in the female. However, it should be considered distinct until males from Zanzibar are examined.

Cylindromyia nigra Villeneuve.
(Pl. I. fig. 9; Pl. II. fig. 16.)

Villeneuve, 1918, Ann. Soc. Ent. France, p. 504 (1917).

A male of this species from Malela, Congo, 1. vii. 1915, has been determined by Dr. Villeneuve as "*Ocyptera nigra* B. B. Sec type." I can find no description of this species by Brauer and Bergenstamm, although it is listed on page 408 of their work on the Muscoidea, credited to "Wd. litt." Villeneuve's remarks constitute the only description, and he says that it appears to be the same as *rufipes* Meigen. As determined by Villeneuve this species is most closely related to *atrata* Fabricius, but has the femora and tibiæ reddish, although the tibiæ are darker.

Length 7–9·5 mm.

Male.—Head silvery-white pollinose; frontal vitta dull reddish, the parafrontals very narrow above. Occiput with white hair. Cheeks with black hair in front. Apical section of the proboscis about as long as the face. Antennæ reddish, the third segment more or less brown on the apical half; arista brown, with about the basal third reddish.

Thorax wholly black, the mesonotum rather thinly whitish pollinose, the vittæ distinct in some views and appearing to form an incomplete dark band immediately behind the suture; pleura silvery-white pollinose in the middle. Dorsocentrals 2—3 or 3—3; scutellum with three pairs of marginals; propleura bare.

Legs reddish, the coxæ and tarsi black, the coxæ with whitish pollen.

Wings broadly brownish along the veins and wholly brown in front. Squamæ white, with yellow border. Knob of halteres brown.

Abdomen black, the sides of the intermediate segments rarely castaneous, the broad bases of the second and third segments white pollinose, the fourth rather thinly white pollinose on more than the basal half, the pollen on the third segment usually expanded dorsally to beyond the middle of the segment. First and second segments each with a pair of marginals, the third and fourth each with a row; first segment with a pair of lateral discals and marginals. Lateral view of genitalia as in fig. 9 (Pl. I.).

Female.—The genital hooks are large and there is a slight excision behind their base; first genital segment with a group of short bristles at lateral apex (Pl. II. fig. 16).

In addition to the specimen from the Belgian Congo I have examined the following:—male, Hope Fountain, S. Rhodesia, 10. i. 1922 (*N. Jones*); male, Weenen, Natal, x. 1924 (*H. P. Thomasset*); male and female, Durban, Natal, 14. v. 1919, 16. iv. 1921 (*C. N. Barker*); female, Umbilo, Durban, Natal, 29. ii. 1920 (*A. L. Bevis*); three males and female, East London, Cape, 19. xi. 1921, 29. x. 1922, 2. ii. 1923, 28. iv. 1923 (*H. K. Munro*); five males, six females, Pretoria, 4, 7, 9, 15. xii. 1915, 1. i. 1915, xi. 1915, 21. iii. 1917, 16. iii. 1918, 1. i. 1920, 7. iii. 1920 (*H. K. Munro*); male, Barberton, 18. iv. 1920, female, Irene, 13. iv. 1914 (*H. K. Munro*); New Hanover, Natal, 16. xii. 1913 (*C. B. Hardenberg*).

From ventral view the genital hooks of the female are about three times as wide as from lateral view, a character which separates it from species which resemble it in colour. The type is in the Vienna Museum of Natural History.

Cylindromyia incerta, sp. n.

(Pl. II. fig. 12.)

Readily distinguished by its large size and absence of marginals on first abdominal segment. Scutellum reddish.

Length 12–15 mm.

Female.—Head rusty reddish, shining, the facial orbits silvery-white pollinose, facial depression whitish pollinose; frontal vitta opaque; about eight pairs of fine frontals and two weak orbitals; ocellars rather weak, a delicate short pair between the posterior ocelli, and similar postocellars; outer verticals absent, a very weak pair of postverticals; ocellar triangle surrounded by a shining depression, occipital pile short, whitish; cheeks similarly clothed, the anterior half of the lower margin with very short fine bristles, the oral vibrissæ scarcely stronger, the facial ridges with inconspicuous bristles on lower one-third; facial carina well marked above; oral margin a little prominent; palpi absent. Antennæ rusty reddish, very long, reaching the oral margin, third segment slightly over twice as long as second, the sides subparallel, the apex rounded. Arista slender, thickened on basal one-sixth or less, the penultimate segment scarcely longer than wide.

Thorax variable; usually ferruginous reddish, the propleura and a median fascia white pollinose, the thorax elsewhere with thin whitish pollen; at other times the disc mostly black, the pollen more yellowish but white on the blackish vittæ, the pectus also blackish. Dorsocentrals 4—3 or 3—3; sternopleurals 2, scutellars 3, the apical cruciate pair almost as strong as the basals.

Legs reddish, coxæ silvery pollinose; tarsi black, the front ones not broadened.

Wings brown in front of the fourth vein, but on the basal two-thirds except in the costal cell the colour is more luteous. Squamæ whitish, halteres yellow with brownish knob.

Abdomen variable; typically ferruginous, with black base and narrow median vitta on first two segments; at other times almost all blackish, with the fourth segment reddish, the sides of the others more or less so; second segment with a narrow grey pollinose fascia, the third almost all greyish pollinose, with a more intense basal fascia. First segment without marginals; second and third with very weak pair, fourth with row of short ones; first to third segments with lateral marginal, the first also with a subbasal; apices of first and second segments with two or four long bristles at ventral corners.

Type, female, Durban, Natal, 16. v. 1915; *paratypes*, female, Umbilo, Durban, Natal, 7. x. 1919 (*A. L. Bevis*); female, Entebbe, Uganda, 1–11. ix. 1911 (*S. A. Neave*).

It is not impossible that this will prove to be the female of *marginalis* Wiedemann, but it does not agree sufficiently well with the description to allow of its being placed there. Its characters are very distinctive notwithstanding its variable colour. The type is in the British Museum of Natural History, a paratype in the American Museum of Natural History.

Cylindromyia sensua, sp. n.
(Pl. II. fig. 13.)

Abdomen red, the base and apex black; legs red, tarsi black; wings blackish in front; three strong scutellars.

Length 9 mm.

Female.—Head silvery-white pollinose, the frontal vitta rusty brownish red, slightly wider anteriorly; eight to ten pairs of frontals and two pairs of orbitals; ocellars and postocellars fairly strong, the secondary ocellars quite weak; outer verticals absent, a weak pair of postverticals; pile of occiput and cheeks rather sparse, white, the cheeks with some black hairs in front; vibrissæ weak but stronger than the bristles along the oral opening; several very short reclinate hair-like bristles on lower fifth of facial ridges; oral margin slightly produced, the carina rather sharp above; palpi represented by a very short bristle, antennæ red, the third segment black on apical third, over twice as long as second segment, with almost parallel sides and subrectangular apex; arista reddish with black apex, sharply tapering from the base, the penultimate segment shorter than wide.

Thorax wholly black; mesonotum moderately grey pollinose, with four dark vittæ in front, the median ones slender, the outer broad, and a broad incomplete dark fascia immediately behind the suture; pleura less thickly pollinose, the propleura and median fascia whitish. Dorsocentrals 3—3 or 2—3; sternopleurals 2; marginal scutellars three pairs, the apical cruciate pair weaker than the basal ones.

Coxæ and femora reddish, the posterior four coxæ blackish on the outer surface, silvery pollinose; tibiæ darker than femora, becoming blackish apically, the tarsi black; front tarsi scarcely widened.

Wings brown in front, paler and with luteous tinge on basal half, the veins clouded, apex greyish, base hyaline behind; posterior cross-vein almost straight, oblique. Squamæ white, halteres rusty reddish.

Abdomen rusty reddish, the broad base, apical three-fourths of third and whole of ultimate segments black; genitalia black basally. First and second segments each with a pair of dorsal and one lateral marginal near apex of segment, the first with two subbasal laterals (1—1). Third and fourth segments with rows of marginals. No discals. Broad base of second and about the basal half of third and fourth segments conspicuously white pollinose.

One female, Zanzibar: Pemba Island, 15–23. ix. 1924 (*H. J. Snell*), in British Museum (Natural History).

Resembles *flavibasis* in general, but the colour and chætotaxy differ. The third antennal segment is unusually long.

Cylindromyia marginalis Wiedemann.

Ocyptera marginalis Wiedemann, 1820, Anal. Ent. p. 41; Wiedemann, 1830, Aussereur. Zweifl. ii. p. 266.

This species was described from a specimen from Cape of Good Hope, and is unknown to me. According to the description the scutellum, pleura, and sides of the mesonotum are reddish and the abdomen is reddish with black base and median vitta.

Cylindromyia soror Wiedemann.

(Pl. I. fig. 8; Pl. II. fig. 17.)

Ocyptera soror Wiedemann, 1830, Aussereur. Zweifl. ii. p. 652.

Abdomen partly reddish; wings dark brown in front; scutellum with four or six bristles, the basal pair very weak or absent.

Length 10 mm.

Male.—Head black, the cheeks and parafacials yellow; silvery-white pollinose, frontal vitta reddish brown, of equal width; about eight pairs of frontals; secondary ocellars almost as strong as the weak ocellars; postocellars and postverticals very weak; outer verticals absent, pile of occiput and cheeks whitish, the latter with some black hairs in front; vibrissæ scarcely stronger than the weak bristles along the anterior fourth of the oral margin, the ridges with obscure fine bristles on lower fourth; oral margin a little produced. Antennæ reddish, reaching the oral margin, third segment about twice as long as the second, its apex rounded, the sides parallel or nearly so; arista slender, thickened on the reddish basal fifth, the penultimate segment not longer than wide.

Thorax black, the humeri mostly reddish; conspicuously ashy pollinose, the four vittæ distinct in front, a transverse darker fascia on the middle immediately behind the suture. Dorsocentrals 3—3; sternopleurals 2; marginal scutellars 3, the basal pair quite weak or practically absent, the apical pair rather weak and cruciate.

Legs reddish; coxæ blackish, silvery pollinose; tarsi black. Pulvilli elongate, luteous.

Wings dark brown in front of the fourth vein, the apical cell with a hyaline triangle, the posterior cross-vein clouded. Squamæ white. Halteres yellow, with black knob.

Abdomen dark reddish, with a wide median vitta extending to the apex of the third segment and more or less distinctly expanding on the segmental apices. First and second segments with pair of marginals, third and fourth each with a row; first two segments each with apical lateral, the first with one subbasal one. Posterior forceps evenly tapering, broad basally, with a deep median line, on either side of which the organ is very strongly convex.

Female.—Similar to the male, but the humeri wholly reddish; scutellum more or less reddish apically. Genitalia as in fig. 17 (Pl. II.).

Two males, Kampala, Uganda, 17. xi. 1915 and 1918 (*C. C. Gowdey*); male, Zomba, Nyasaland (*H. S. Stannus*); female, Barberton, S. Africa, 8. x. 1919 (*H. K. Munro*); male, Salisbury, S. Rhodesia, 30. v. 1919; male, Burunga, Congo (*J. Bequaert*).

I have examined the type of this species, and it agrees with the male described. However, a blackish form exists, and in this there is very little red on the sides of the abdomen and the femora are mostly black, although red below.

Cylindromyia oxyphora Villeneuve.
(Pl. I. fig. 6.)

Ocyptera oxyph(o)ra Villeneuve, 1925, Encycl. Ent. ii. p. 192 (*oxyphera*, error).

I have examined the type of this species and prepared a figure of the male genitalia (Pl. I. fig. 6). The species should be recognized without difficulty. It is a small black species with the sides of the intermediate abdominal segments reddish, the scutellum with three pairs of marginals.

Length 6 mm.

Known only from two males from Algoa Bay, S. Africa.

Cylindromyia xiphias Bezzi.
(Pl. I. fig. 7; Pl. I. fig. 22.)

Ocyptera xiphias Bezzi, 1908, Bull. Soc. Ent. Firenze, xxxix. p. 65.

Scutellum with three pairs of bristles; wings yellow on basal half in front, thence brown to the end of the veins; almost hyaline behind and in the discal and apical cells.

Length about 10 mm.

Male.—Black, the head partly and about half the abdomen reddish yellow in ground-colour. Head thickly silvery-white pollinose; frontal vitta reddish brown, increasing in width above where the parafrontals become linear; about ten pairs of rather fine frontals; one or two pairs of fairly strong ocellars, another pair behind and the postocellars well developed; front without hairs; outer verticals slightly developed; pile of occiput and cheeks white; no bristles along the oral margin except between the oral angles and vibrissæ, which are fairly strong, the other bristles weak; oral margin conspicuously produced; apical section of proboscis is somewhat longer than head-height; palpi entirely absent; antennæ black, the immediate base of third segment yellow; third segment one-and-one-third as long as second, rounded apically; arista brown, thickened on basal two-fifths, thence tapering, penultimate section longer than wide.

Mesonotum with conspicuous grey pollen, in some views with four black vittæ, the outer pair very wide, interrupted at the suture; between the inner pair is a double row of well-developed acrostichal hairs, which are widely separated from the other two rows of hairs which lie just inside the dorsocentrals; pleura very thinly pollinose, the propleura and a broad median fascia thickly so. Acrostichals absent; dorsocentrals 3—3; sternopleurals 2; marginal scutellars three pairs, the apical pair a little weaker than the basal and cruciate. Squamæ white; halteres yellow.

Legs black; coxæ silvery white; pulvilli long, luteous.

Abdomen with the first (first and second) segment broadly black basally, reddish yellow on apical half and with a broad median vitta which hardly attains the apex; second segment reddish yellow with an apical black triangle which reaches almost or quite to the base, or wholly pale. Third black with a transverse pale basal area on either side, fourth and genitalia black, the apical half of the latter (the appendages) reddish. Second segment with a narrow basal white pollinose fascia, third whitish pollinose with the apical fourth bare; fourth pollinose on basal half. First segment with three lateral bristles, subbasal, submedian, and apical, and a pair of strong dorsal marginals well before the apex; second with a pair of marginals and one lateral marginal; second and third each with subapical row of marginals. Posterior forceps (dorsal view) strongly narrowed to their middle, thence slightly widening to the rounded apex; outer forceps broad, rounded above, produced as obtuse, short lobe below.

Three males, Barberton, S. Africa, viii. 1913 (*L. S. Hardenberg*). One female, Mt. Mlanje, Nyasaland, 6500 ft., 14. xi. 1913 (*S. A. Neave*). Type in Munro collection; allotype in British Museum (Natural History).

This species is rather like *C. flavibasis* Villeneuve, but is at once distinguished by the more extensively yellow wings, chætotaxy, and presence of at least a partial median black abdominal vitta.

Cylindromyia insolitum Curran.
(Pl. II. fig. 14.)

Curran, 1927, Amer. Mus. Novit. no. 248, p. 1.

Propleura with from one to three bristly hairs on the median portion; abdomen moderately pedunculate; legs blackish, the knees reddish.

Length 12–15 mm.

Male.—Head brownish, the parafacials transparent yellow, white pollinose, with the upper two-thirds bare on the inner half; parafrontals except a large spot below, the cheeks except a large rectangular spot in front, and the occiput silvery-white pollinose, the posterior orbits bare above. Facial carina strong, rounded, obsolete below, the facial depression silvery pollinose. Frontal vitta very broad, the front two-thirds as wide as either eye; frontal bristles weak, converging, a single reclinate frontal above. Ocellars rather strongly diverging; verticals strong, convergent. A row of short black occipital setæ above behind the cilia; pile of head pale yellowish; cheeks with black hairs on the anterior half. Oral vibrissæ weak, but distinctly developed. Palpi wholly wanting. Antennæ brownish, the incisures reddish; arista brown, with the enlarged basal fifth reddish; third antennal segment two-and-a-half times as long as the second, the antennæ reaching almost to the oral margin.

Thorax black, whitish pollinose, the mesonotum thinly so; acrostichal bristles absent; dorsocentrals 3—3; sternopleurals 1—1; three pairs of marginal scutellars, the apical pair decussate. Scutellum broadly reddish apically.

Legs black, the femora castaneous, thinly whitish pollinose, the apices reddish, the bases of the tibiæ narrowly so; pulvilli brown.

Wings brown in front of the fifth vein, with the posterior portion, the broad posterior border apically, most of the discal cell, and a triangular streak in the apical cell greyish hyaline. Squamæ whitish hyaline, with yellow margin. Halteres reddish brown, the knob deep brown.

Abdomen black or brownish black, more brownish beneath, thinly whitish pollinose, the first segment reddish on the posterior three-fifths except a broad dorsal vitta, which becomes obsolete behind, the second segment more or less reddish on the broad base laterally. Bases of the second and third segments narrowly sericeous pollinose, less so medianly, more broadly so below; second segment with two or three fine long bristles at the ventral corners; second with one pair, the third with two pairs of marginals, the fourth with an apical row of scarcely differentiated apical bristles; first segment with one lateral bristle. Second segment unusually narrowed but still wide, widest basally, gradually slightly increasing in width from the middle to the apex.

Male, Stanleyville, Congo, iii. 1915, and male, Stanleyville, 8. iv. 1915. Type in American Museum of Natural History.

A large striking species. *C. pedunculata* Curran bears only one pair of anterior dorsocentral bristles, lacks the propleural hairs, has a more strongly constricted second abdominal segment, and wholly black abdomen.

Cylindromyia euprepia Speiser.
(Pl. I. fig. 11; Pl. II. fig. 19.)

Ocyptera euprepia Speiser, 1910, Kilimandjaro Meru Exp. x. p. 143.

A male and female from Uganda. These specimens agree with Speiser's description, but not with the descriptions of Walker and Macquart, of the two following species. Whether these three names all apply to the same species can only be determined by an examination of the types. At any rate, they form a peculiar group, in which the second genital segment of the female forms a complete cylinder, no ventral opening being present.

Cylindromyia picta Walker.

Ocyptera picta Walker, 1849, List. Dipt. Brit. Mus. iv. p. 695.

The type, from Sierra Leone, is in the British Museum (Natural History).

Cylindromyia pictipennis Macquart.

Ocyptera pictipennis Macquart, 1830, Hist. Nat. Dipt. ii. p. 186.

The location of the type is unknown to me.

Cylindromyia atypica, sp. n.
(Pl. I. fig. 5 ; Pl. II. fig. 15.)

Differs from described species of *Ocypterula* in that the male has the arista simple, not at all thickened or widened apically ; abdomen mostly reddish.

Length 9 mm.

Male.—Face yellowish, the head elsewhere black, densely silvery-white pollinose, the parafrontals bare on upper two-thirds ; frontal triangle opaque black, widened anteriorly, about one-and-a-half times as wide as parafrontal ; ocellar region brownish black ; about six pairs of weak frontals ; ocellars fairly strong, divergent ; postocellars and postverticals very small ; verticals long ; outer verticals absent. Pile of occiput sparse, pale yellowish, the occiput concave and bare above, and with several black bristles on either side above the neck ; cheeks narrow, with a row of black bristly hairs below, the cruciate vibrissæ strong, a few minute hairs above them. Parafacials narrow, scarcely widened above ; facial carina entire, low but strong, vibrissæ arising below level of anterior oral margin. Antennæ situated at upper fourth of eyes, reaching to the oral margin ; third segment three-and-a-half times as long as second, with parallel sides, its apex truncate, the corners rounded ; arista reddish, black and thin on apical half, evidently pubescent, the penultimate segment three or four times as long as wide. Base of third and tip of second antennal segments reddish.

Thorax black, moderately whitish pollinose, the propleura and median pleural fascia silvery white ; dark mesonotal vittæ not conspicuous. Only the posterior pair of dorsocentrals are present, a single sternopleural, and a single strong pair of scutellars, although there is a very weak divergent apical pair.

Legs black ; coxæ silvery pollinose ; pulvilli small, yellow.

Wings conspicuously brownish, darker in front and apically. The fourth vein extends in a rounded curve and joins the third vein at a right angle as in *Alophora*. Squamæ white ; halteres black, the stem partly reddish.

First abdominal segment blackish basally, elsewhere rusty reddish ; second reddish on basal half or less, the abdomen elsewhere black. Bases of second to fourth segments broadly silvery-white pollinose. Each segment bears a single pair of strong marginals and a single lateral one, while the first segment also bears a lateral near its basal one-third.

The female differs only sexually.

Described from three specimens from Kampala, Uganda *Type*, male, 17. xi. 1915; *allotype*, female, 10. xii. 1916, and male, 19. xi. 1917, all collected by Mr. C. C. Gowdey. Type in the British Museum (Natural History).

Cylindromyia ugandana, sp. n.

Abdomen wholly black.

Length 9 mm.

Male.—Very similar in most respects to *atypica.* The antennæ are black, with just a trace of reddish at the base of the third segment, which is almost five times as long as the second; parafacials a little narrower; frontal bristles stronger above; a single black bristle on either side above the neck; abdomen wholly black, the broad base of second to fourth segments white pollinose. In all other respects similar to *atypica.*

Holotype, male, and two male *paratypes*, Kampala, Uganda, 17. xi. 1915, and male, Kampala, 20. xi. 1917 (*C. C. Gowdey*).

EXPLANATION OF THE PLATES.

Plate I.

Lateral view of male genitalia of *Cylindromyia.*

Fig. 1. *Cylindromyia flavibasis* Villeneuve.
Fig. 2. —— *ethelia*, sp. n.
Fig. 3. —— *completa* Curran.
Fig. 4. —— *atrata* Fabricius.
Fig. 5. —— *atypica*, sp. n.
Fig. 6. —— *oxyphora* Villeneuve.
Fig. 7. —— *xiphias* Bezzi.
Fig. 8. —— *soror* Wiedemann.
Fig. 9. —— *nigra* Villeneuve.
Fig. 10. —— *eronis* Curran.
Fig. 11. —— *euprepia* Speiser.

Plate II.

Lateral view of female genitalia of *Cylindromyia.*

Fig. 12. *Cylindromyia incerta*, sp. n.
Fig. 13. —— *sensua*, sp. n.
Fig. 14. —— *insolitum* Curran.

Fig. 15. *Cylindromyia atypica*, sp. n.
Fig. 16. —— *nigra* Villeneuve.
Fig. 17. —— *soror* Wiedemann.
Fig. 18. —— *atrata* Fabricius.
Fig. 19. —— *euprepia* Speiser.
Fig. 20. —— *eronis* Curran.
Fig. 21. —— *lavinia*, sp. n.
Fig. 22. —— *xiphias* Bezzi.

XI.—*Some Spirurid Nematodes from Queensland*. By H. A. Baylis, M.A., D.Sc., Department of Zoology, British Museum (Natural History).

The following is a continuation of a series of papers dealing with helminthological material in the collection of the School of Public Health and Tropical Medicine, Sydney, N.S.W., and formerly in the collection of the Australian Institute of Tropical Medicine, Townsville, North Queensland. Co-types of the new species described will be deposited in the British Museum (Natural History) and in the collection at Sydney.

Family **Spiruridæ**.

Subfamily *Spirurinæ*.

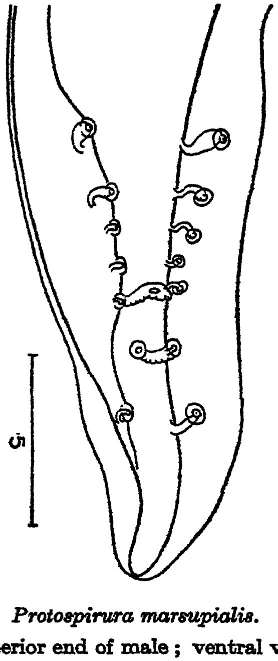
Protospirura marsupialis Baylis, 1927. (Fig. 1.)

This species was originally recorded (Baylis, 1927) from an opossum (probably *Trichosurus vulpecula*) at Townsville, North Queensland, the type material consisting of females only. The present collection contains specimens obtained in 1911 from the stomach of *T. vulpecula* (locality not stated). These include several males, and thus enable the original description to be completed. The specimens had been mounted in Canada balsam, but some of them have been unmounted and re-cleared.

The male measures about 30–40 mm. in length and 0·8 mm. in maximum thickness. The pharynx (measured from the extremity of the lips) is about 0·2–0·27 mm. long, and the distance from the anterior extremity to the posterior end of the œsophagus is about 3·6–4·5 mm. The nerve-ring is situated at 0·36–0·45 mm., the cervical papillæ at 0·32–0·42 mm., and the excretory pore at 0·5–0·55 mm. from the anterior extremity.

The caudal end has well-developed alæ, and the cuticle of its ventral surface is, as usual in the genus, longitudinally ridged and tessellated. The arrangement of the caudal papillæ is typical, but slight variation was observed in their number. In at least two specimens there were five pairs of preanal papillæ, as shown in fig. 1, while in others only four pairs could be found. On the prominent anterior lip of the cloacal aperture, and between the most posterior pair of preanal papillæ, there is a median papilla. There are two pairs of large postanal papillæ, the anterior pair being situated near the mid-ventral line and usually on a prominent transverse ridge of the cuticle, while the posterior pair are more laterally placed. In all probability there are some very small sessile papillæ near the tip of the tail, but these could not be clearly made out. The left spicule is slender and measures about 0·9–1·15 mm. in

Fig. 1.



Protospirura marsupialis.
Posterior end of male; ventral view.

length. The right spicule is considerably stouter and a little longer, measuring 1·15–1·35 mm. Both spicules have blunt tips. A short and broad accessory piece is present.

The length of the spicules in *P. marsupialis* is about the same as in the common *P. muris* of rats and mice, while the arrangement of the caudal papillæ is very uniform in most of the species of *Protospirura*. The unusual length of the pharynx, as was noted in the description of the female, appears to be the most distinctive character of *P. marsupialis*.

Subfamily *ACUARIINÆ*.

Acuaria (*Dispharynx*) *fieldingi*, sp. n.

(Figs. 2 & 3.)

This species was obtained by Mr. J. W. Fielding from the stomach of a " white hawk " (? *Astur novæ-hollandiæ*). The locality is not stated.

The male measures about 10–11·6 mm. in length and 0·23–0·28 mm. in maximum thickness, the female 14–15·5 mm. and 0·4–0·44 mm. respectively. The cuticular striations are at intervals measuring up to 10 μ in the male and 14 μ in the female. The arrangement of the cephalic cordons is that typical of the subgenus. Their recurrent branches are long, and almost meet in some specimens. The posterior loops of the cordons extend to a distance of 0·34–0·37 mm. from the anterior extremity in the male and 0·42–0·47 mm. in the female. The cervical papillæ, which have the form of simple, backwardly-curved spines, are situated a little in front of the posterior limit of the cordons and between their recurrent branches. The distance from the anterior extremity to the posterior end of the narrow tubular pharynx is 0·15–0·22 mm., to the end of the œsophagus 3·3–4·2 mm., and to the end of its anterior, muscular portion about 0·9–1·1 mm. The nerve-ring is situated at about 0·3 mm. and the excretory pore at about 0·47–0·6 mm. from the anterior end.

The posterior end of the male is spirally coiled. The tail is about 0·36 mm. long. There are well-developed caudal alæ, into which project nine pairs of pedunculate sublateral papillæ. Of these, four are preanal and five postanal. With the exception of the posterior papilla, those of each side are arranged in pairs. Between the posterior pair of sublateral papillæ there is a pair of small subventral papillæ or pores (fig. 3, *s.*). These are visible only in ventral view and under a high magnification. The left spicule is slender and narrowly alate, and measures 0·95–1 mm. in length. The right spicule is of the peculiar shape indicated in fig. 2, and is 0·24–0·27 mm. long. The tips of both spicules are curved dorsally, forming a more or less pronounced hook.

Fig. 2.

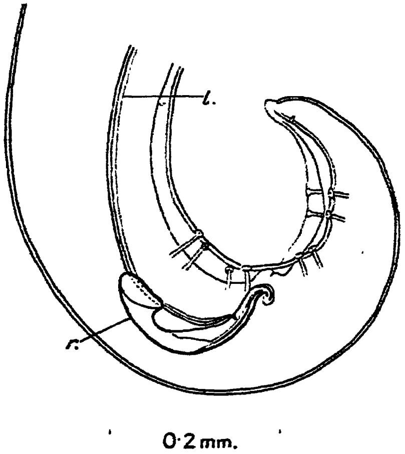
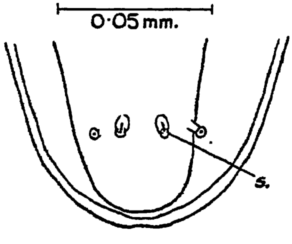


Fig. 3.



Acuaria (Dispharynx) fieldingi.

Fig. 2.—Posterior end of male; lateral view. *l.*, left spicule; *r.*, right spicule.
Fig. 3.—Tip of tail of male; ventral view. *s.*, submedian papilla.

The tail of the female is very short (about 0·15–0·17 mm.) and blunt, and is slightly curved ventrally. It bears a pair of small subventral papillæ near the tip. The vulva is situated at a distance of 6·6–7·5 mm. from the posterior end—*i. e.*, it is usually just behind the middle of the body, but in the smallest specimen just in front of the middle. The vagina is short and muscular, and runs posteriorly from the vulva. The eggs are typical of the genus, having thick shells and containing coiled embryos, and measure 0·038–0·042×0·022–0·024 mm.

Of the known species of the subgenus *Dispharynx* this form seems to approach most closely to *D. laplantei* Seurat, 1919. Seurat's species, which is recorded from the jay (*Garrulus glandarius*) in North Africa, is rather smaller but has longer cordons, extending to over 0·8 mm. in the female. Moreover, the vagina (" vestibule " of Seurat) runs at first anteriorly from the vulva, and then bends posteriorly at a sharp angle.

Subfamily *PHYSALOPTERINÆ*

Heliconema brevispiculum, sp. n.

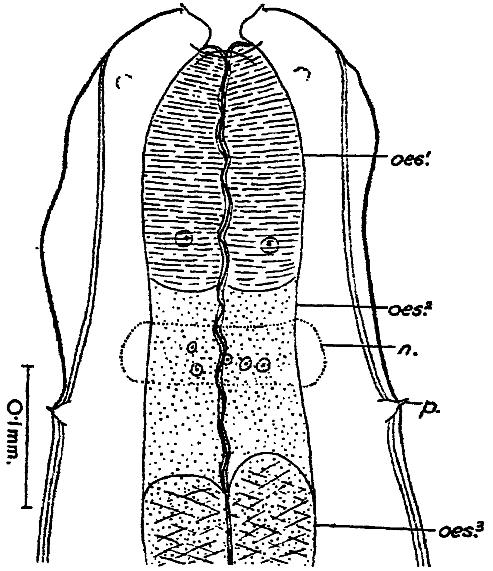
(Figs. 4–7.)

This parasite occurred in considerable numbers in the stomach of a sharp-nosed eel (*Murænesox cinereus*) at Townsville. The material was collected by Mr. M. J. Dillane. The specimens are, unfortunately, rather fragile, and the cuticle is very easily damaged during manipulation. The male measures approximately 16–19·5 mm. in length and 0·2–0·26 mm. in maximum thickness, the female 18–27 mm. and 0·33–0·4 mm. respectively. The posterior portion of the body, in the male, is coiled like a left-handed corkscrew of three or four turns, while in the female it is straight. The cuticle has fine transverse striations, the intervals between them measuring up to 5–6 μ in the anterior part of the body. The cuticle is somewhat inflated in the cervical region, as far back as the cervical papillæ, and in some specimens (fig. 5) forms a collar surrounding the lips, as in *Proleptus*.

Each lip (figs. 4 & 5) bears on its inner surface a single small conical tooth. The total length of the œsophagus, measured from the anterior extremity, is 2·2–2·6 mm. in the male and 3–3·2 mm. in the female. At a point about 0·29–0·38 mm. from the anterior extremity it shows a well-marked division into two portions, the longer posterior portion (fig. 4, *oes.*^{3}) being partly granular and partly muscular. The anterior portion itself is also divided into two regions of different histological appearance. The anterior part (fig. 4, *oes.*^{1}) appears to be purely muscular, the posterior part (*oes.*^{2}) purely granular. The latter is surrounded by the nerve-ring, which is situated at about 0·2–0·25 mm. from the anterior end. The rather prominent cervical papillæ are situated a little behind this at about 0·27–0·3 mm., and the excretory pore at 0·36–0·43 mm. from the anterior end.

The spirally coiled posterior portion of the male bears a broad asymmetrical ala (fig. 6, *a*), which ceases some little distance in front of the cloacal aperture. This ala shows well-marked longitudinal striations, but the ventral surface does not appear to be tessellated as in *H. heliconema*. There are also fairly well developed caudal alæ, which tend to assume the appearance of a series of separate

Fig. 4.



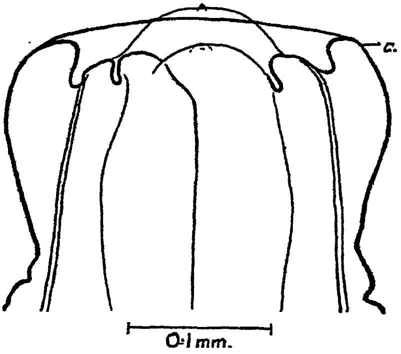
Heliconema brevispiculum.

Anterior end of female; dorsal view.

n., nerve-ring; *oes.*^{1}, *oes.*^{2}, *oes.*^{3}, the three portions of the œsophagus; *p.*, cervical papilla.

lobes supported by the long pedunculate papillæ. These papillæ (fig. 6) agree in number and arrangement with those of the genotype, as described by Travassos (1919), *i. e.*, there are ten pairs, four of which are preanal. Beginning at the anterior end of the series, the papillæ of one side are grouped as follows :—2, 2, 1, 2, 1, 2. The tail is about 0·6 mm. long. The spicules are unequal, but their disparity is not nearly so great as in *H. heliconema.* The left spicule measures 0·5–0·52 mm. in length, and is relatively slender and tapering. It is alate for some part of its length. The right spicule is broad and measures 0·23–0·25 mm. in length.

Fig. 5.



Heliconema brevispiculum.

Anterior end of female ; lateral view of specimen with cuticle forming a collar (c.).

The tail of the female is 0·22–0·27 mm. long, conical and rapidly tapering. The vulva (fig. 7, *v.*) is situated at about 8–9·5 mm. from the anterior end of the body. It has a rather overhanging anterior lip, and leads into a subglobular muscular enlargement of the vagina, or ovejector (fig. 7, *o.*), on the postero-dorsal surface of which there are several large unicellular glands (*g.*). The vagina (*va.*) is muscular and runs posteriorly for a distance of about 0·55–0·65 mm. At its hinder end it gives off two uterine branches (*ut.*) which are at first narrow, but widen gradually. These run parallel posteriorly for a distance of about 3–4 mm. from their origin. One branch then doubles upon itself and runs anteriorly to end in an outstretched ovary which extends to about the level of the middle of the œsophagus. The posterior ovary is reflexed, and forms several loops which extend to within 2–4 mm. of the posterior end of the body. The eggs are roundish-oval and very thick-shelled. They contain embryos when ready for laying, and measure, when fully formed, 0·035–0·038 × 0·024–0·026 mm.

Fig. 6.

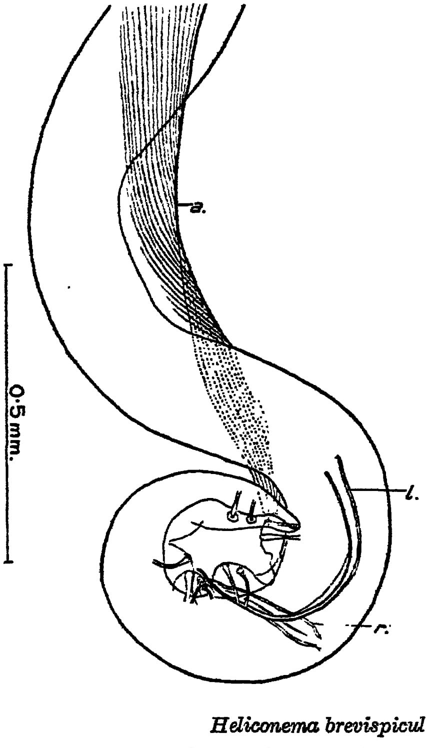
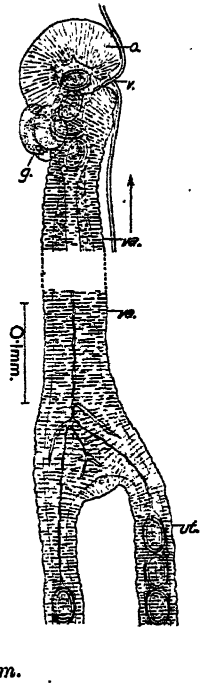


Fig. 7.



Heliconema brevispiculum.

Fig. 6.—Posterior end of male; lateral view. *a.*, ala; *l.*, left spicule *r.*, right spicule.

Fig. 7.—Vagina and associated structures of female. *g.*, glands; *o.*, ovejector; *ut.*, uterus; *v.*, vulva; *va.*, vagina. The arrow points towards the anterior end.

The only species of *Heliconema* described up to the present appears to be *H. heliconema* Travassos, 1919. In this form, which is recorded from the stomach of a fish (*Echidna catenata*) off Trinidad, the longer spicule of the male attains a length of 3·5–4·1 mm. For this reason, apart from other differences, it is quite clear that the Australian species is distinct from it.

The genus *Heliconema* is evidently very closely related to *Proleptus*, but there is an important difference in the position of the vulva. In *Heliconema* this is in front of the middle of the body, while in *Proleptus* it is behind the middle, and usually near the anus.

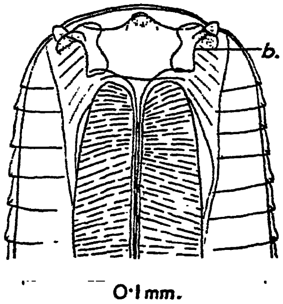
Subfamily *Thelaziinæ*.

Thelazia aquilina, sp. n.

(Figs. 8–10.)

The collection contains three sets of this species:—(1) from the eyes of a wedge-tailed eagle (*Uroaëtus audax*), collected at Townsville by Mr. J. W. Fielding; (2) from the conjunctival sac of a brown hawk (*Hieracidea berigora*), collected at Cromarty by Dr. W. Nicoll; (3) from the eyes of a white-bellied sea-eagle (*Haliaëtus leucogaster*), collected at Cromarty by Mr. J. W. Fielding.

Fig. 8.

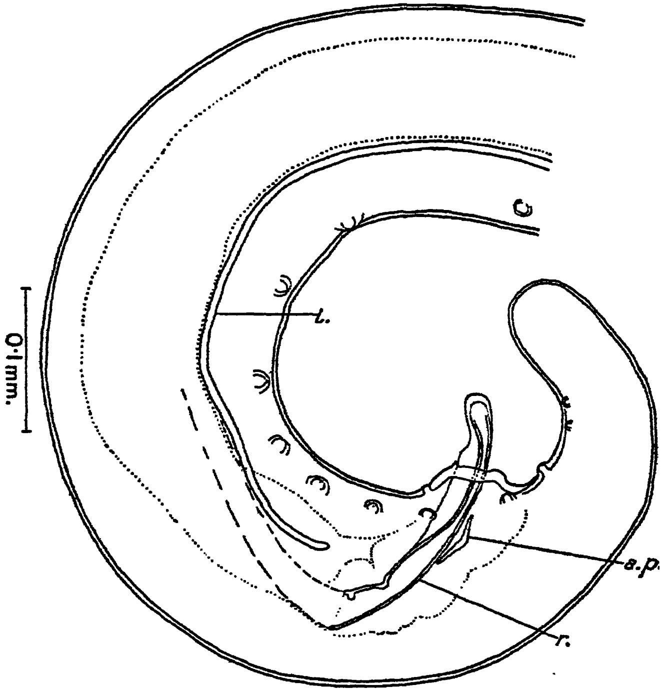


Thelazia aquilina.
Anterior end of female; lateral view.
b., buccal capsule.

In the last-mentioned case the material consists of a single male, and in the second case of two males and one female. From the first-mentioned host there are ten specimens in good condition, and these are taken as the types.

The male measures 14–15 mm. in length and 0·32–0·36 mm. in maximum thickness, the female 18–19 mm. and 0·37–0·46 mm. respectively. The cuticular striations are moderately prominent, and in both sexes the interval between them increases gradually from about 10 μ near the head to about 40 μ in the middle region of the body, thence decreasing again gradually towards the tail. The diameter of the head, at the level of the base of the buccal

Fig. 9.



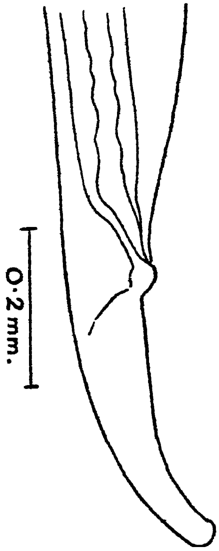
Thelazia aquilina.

Posterior end of male; lateral view.

a.p., accessory piece; *l.*, left spicule; *r.*, right spicule.

capsule, is about 0·09–0·1 mm. The buccal capsule measures, in the male, 0·016–0·02 mm. in length and 0·03 mm. in maximum inside diameter; in the female 0·02–0·024 mm. and 0·034–0·036 mm. respectively. The distance from the anterior extremity to the posterior end of the œsophagus is 0·82–1·05 mm. in the male and 0·94–1·2 mm. in the female. The nerve-ring is situated at about 0·35–0·4 mm., and the cervical papillæ and excretory pore at about 0·5–0·6 mm., from the anterior extremity.

Fig. 10.



Thelazia aquilina.
Posterior end of female; lateral view.

The tail of the male (fig. 9) is bluntly rounded and measures 0·22–0·25 mm. in length. There are four pairs of postanal papillæ and usually eight pairs of preanal papillæ, though in one specimen from *Hieracidea* ten pairs were seen. There is also a median preanal papilla. The right spicule is short (0·2–0·23 mm.) and broad, and has a very blunt tip. The left spicule is long (approximately 2 mm.) and very slender. At its proximal end this spicule is tubular, but at a distance of about 0·5–0·6 mm. from its root the shaft suddenly narrows and a small ala becomes visible for a short distance, producing the appearance of a fusiform thickening, such as has been described and figured by Travassos (1918) in *T. campanulata*. A small chitinoid thickening is present in the dorsal wall of the cloaca, representing a rudimentary accessory piece.

The tail of the female (fig. 10) is slightly curved ventrally and measures about 0·3–0·37 mm. in length. It has a blunt tip, and bears a pair of minute sub-terminal papillæ. The posterior lip of the anus is rather prominent. The vulva is situated at 0·66–0·79 mm. from the anterior end of the body. The vagina, which runs posteriorly, expands almost at once into an elongate thin-walled reservoir, which, at a distance of 1·4–1·6 mm. from the vulva, narrows suddenly into a muscular duct. This, after a further course of about 1 mm., gives off the two uterine branches.

This species bears a very close resemblance to the South American form *Thelazia campanulata* (Molin, 1858), as redescribed by Travassos (1918), and may even be identical with it. It is here treated as a distinct species because of the following points in which it differs from Travassos' description :—(1) The length of the œsophagus, which measures only 0·46–0·6 mm. in *T. campanulata*, according to Travassos ; (2) the distance of the vulva from the anterior end (Travassos gives only 0·35 mm.) ; (3) the number and arrangement of the caudal papillæ in the male (Travassos describes three pairs of postanal and seven pairs of preanal papillæ, and a median postanal as well as a median preanal papilla).

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XII.—*On the Life-History of* Nephrostomum ramosum *Sonsino*, 1895. *An Echinostome Parasite from* Ardeola ibis ibis (*Buff-backed Heron*). By M. Abdel Azim, Research Institute, Cairo, Egypt.

[Plate III.]

During a survey of trematode infection in snails of El Marg, a district near Cairo, notable for the discovery of the life-history of human *Schistosoma* in Egypt, fifty snails of the species *Planorbis boissyi* were collected. Ten of these were found to be infected with mature Echinostome cercariæ. Further investigations disclosed that this infection was very common in this area. Previous records did not go beyond a mere reference to its presence in these snails.

The body of the cercaria is about 0·45 mm. in length and 0·28 mm. in breadth. The tail is 0·6 mm. in length and 0·08 mm. in breadth at the proximal end. At the anterior end there is a collar provided with 48 spines, each measuring ·027–·04 mm. in length and ·011–0·13 mm. in breadth. The oral sucker is ·07 mm. in diameter and the ventral sucker is ·09 mm. in diameter.

The digestive tract is surrounded by a very well-developed pharynx. The œsophagus continues down to the anterior margin of the acetabulum, where it bifurcates into two cæca which pass downwards to the caudal extremity of the body.

The excretory system consists mainly of two trunks. Each starts as a capillary on the postero-lateral border of the oral sucker, passes abruptly laterally and then posteriorly to the level of the acetabulum. In this course it becomes dilated and full of dark globules. Meanwhile, it receives short tributaries on either side. Further posteriorly, it becomes thinner and convoluted until it reaches the caudal extremity, where it passes to the median line and joins the trunk on the other side in a chamber received in the main excretory vesicle. The postero-lateral region of the body is drained by a group of capillaries which are received also in the vesicle. The tail is drained by a single trunk (Pl. III. fig. 4).

The genital organs are poorly developed, and only occasionally a mass of cells can be seen anterior to the vesicle.

The whole body is full of cystogenous glands. There is also a bunch of numerous batonets which lie immediately posterior to the oral sucker. These have not been recorded in other Echinostome cercariæ, and may be considered as a distinctive feature of this species. In the author's opinion, they represent main ducts of the cystogenous glands—a view which is supported by their absence in immature forms and by their disappearance when the cysts are completely developed.

The early stages of development in the snail were found in the liver and visceral cavities. Rediæ of different sizes are met with. The mature rediæ (Pl. III. fig. 2) are 2 mm. in length and 1 mm. in breadth. There is a constriction at the junction of the middle with the anterior third. It has an oral sucker and a rhabdocele gut. Many cercariæ are seen in the rediæ together with balls of germinal cells. The birth-pore is anteriorly situated just below the constriction. Immature rediæ are much smaller and contain only germinal cells (Pl. III. fig. 3). Encysted metacercariæ were found neither in the snails' muscles nor in the rediæ.

Encystment.—A batch of tadpoles was secured from a pond free from snails. Some of these were kept as a control. The rest were exposed to infection by putting them together with enormous numbers of mature cercariæ. After 48 hours, specimens were taken out and dissected, revealing the presence of cysts, ·23 mm. in diameter, enclosing Echinostome metacercariæ, particularly in the renal tissue (Pl. III. figs. 5 & 6). Comparison of these metacercariæ (Pl. III. fig. 7) with the free-living cercariæ proved that they were identical. Although the intestines of these tadpoles showed cercariæ in their lumen, the presence of these cysts in the connective and muscular tissues after a few hours showed that the common route of infection is through the skin.

Two days later the cyst-wall becomes thicker and firmer. The excretory canals increase in diameter and the pharynx and ventral sucker become more muscular. The batonets above mentioned have become thinner. One-week-old cysts showed the excretory system full of dark globules, the crown of spines became more conspicuous, and a group of granules was seen in the place of the batonets.

Kittens, pups, and white rats, brought up in the laboratory, were fed on tadpoles' tissues harbouring cysts seven days old; when they were sacrificed forty-eight hours later, there was no evidence of parasites. Two other groups of animals were fed on cysts fifteen and twenty-one days old consecutively. It was in the latter group that the parasites appeared. Although the parasites were liberated in the small intestines of these animals, they disappeared after two weeks and thus it was necessary to look for more appropriate hosts. Pigeons, chickens, and ducklings were tried, but they failed to give a more satisfactory result.

As the infection of molluscs with these cercariæ is very common in this area, a search for the definitive host has been conducted among the birds frequenting this locality. It has led to the discovery of adult Echinostomes with immature stages in the small intestines of *Ardeola* (*Bubulcus*) *ibis ibis* (the common Buff-backed Heron), which is found in very great numbers all the year round and whose nests are commonly found among the leaves of palm trees. It is a carnivorous bird, feeding voraciously on fish, tadpoles, and insects found in the puddles that abound in fields.

A comparison of the number of spines, their arrangement, and the features of the excretory system with those of the parasites secured from the experimental animals, revealed their complete identity.

Unfortunately, it was impossible to determine the time necessary for the parasites to reach maturity, owing to the difficulty of getting herons free from previous infection, and keeping them in captivity for a period sufficient for the appearance of the eggs of the parasites in their fæces.

Sonsino (1895) discovered the adult parasite in the same host. He described it and named it *Echinostomum ramosum*. Dietz (1909) created the genus *Nephrostomum* to contain this parasite as its type-species. He described it also in detail in his monograph 'The Echinostomidæ of Birds.'

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EXPLANATION OF PLATE III.

Fig. 1. Cercaria of *Nephrostomum ramosum.*
Fig. 2. Redia containing different stages of cercaria.
Fig. 3. Immature redia.
Fig. 4. Body of cercaria showing details of excretory system. B, indicates the batonets.
Fig. 5. Kidney of a tadpole, with the renal artery showing distribution of the encysted cercariæ.
Fig. 6. Encysted cercaria.
Fig. 7. Metacercaria removed from the cyst.

XIII.—*Notes on the Fallow Deer of Asia Minor.* By EDGAR N. BARCLAY. From the Department of Zoology, British Museum (Natural History).

LYDEKKER states ('Great and Small Game of Europe, W. & N. Asia, and America,' 1901, pp. 245–246) that the Mesopotamian fallow deer, *Dama mesopotamica*, occurs in Asia Minor. This statement appears to be based on the quite erroneous supposition that certain antlers in the possession of Mr. F. E. Whittall of Istambul are referable to that species. In response to my enquiry Mr. Whittall has been kind enough to send me a detailed reply, together with a photograph, which shows quite unmistakably that his specimens belong to the typical species, *Dama dama.* His letter is of such interest that I subjoin the following extracts :—

"My own acquaintance with fallow deer dates back to quite 40 years ago and I only secured two heads and shot two does in all. . . . I do not think my heads are of the Persian type which I believe is not palmated."

Mr. Whittall's largest pair of antlers measure 37½ inches on the outside curve and weigh 6½ lb. with the frontlet. The buck that carried these antlers was shot at a village some twenty miles from Karaboga, where it was afterwards weighed by Mr. Whittall's agent, who reported it to be 24 stone—uncleaned. Mr. Whittall then goes on to say :—

"The port of Karaboga lies on the South Westerly side of the Sea of Marmora and this is the only spot in Northern Asia Minor where the fallow deer existed some 40 years ago. My sons have been there several times since the war and they tell me that it is extinct, or at all events, they found none and the local sportsmen had not seen any for many years. There were very few left 40 years ago when I obtained my heads! I may add that a few specimens of this deer still existed in the marshy grounds on the Gulf of Xeros, North East of Gallipoli, on the European side of Marmora in 1860 to 1870, but they had all been shot before my day.

"In no other part of Northern Asia Minor or European Turkey have I ever heard of the presence of fallow deer except as above and at, or near Karaboga. Had they existed I should have heard from my Firm's Agents all over Asia Minor who had standing instructions to report to me *re* the game in their respective districts. Also, I used to travel much and myself shot in Western Asia Minor and I would certainly have heard of their presence elsewhere.

"Fallow deer still exist on the Northern and Southern foothills of the Western Taurus Range of Mountains in South Western Asia Minor, but I have never shot there myself. The heads which I have seen were the same as those from Karaboga—palmated."

The last statement is fully confirmed by a specimen now in the British Museum which was collected by Danford in Adalia and is referable to *D. dama*.

The antlers of the bucks in these two forms of deer afford unmistakable characters, which can be appreciated from the excellent figures given by Brooke (Proc. Zool. Soc. 1875, pp. 263–264, figs. 2 & 3, and 1876, pp. 298–303, figs. 1–4)—in fact, no other species of a single genus display such essential differences in antler pattern. Errors in the determination of bucks should not therefore occur, but I have had no opportunity of examining a female specimen of *D. mesopotamica*, and, so far as I am aware, the does of this species have never been adequately described.

BIBLIOGRAPHICAL NOTICES.

The Nidification of the Birds of the Indian Empire. Vol. III. By E. C. Stuart Baker, C.I.E., O.B.E., F.Z.S., &c. Pp. vii+568, and 8 Plates. Taylor & Francis, Red Lion Court, Fleet Street, London, E.C. 4. Price 30*s*.

This volume describes the breeding habits of the last one-fifth of the Passeres and of all the Coraciiformes. The families dealt with under the order Passeres are the Weavers, Finches, Swallows, Wagtails, Larks, White-eyes, Sunbirds, Flowerpeckers, Pittas, and Broadbills.

Under the order Coraciiformes we find the Woodpeckers, Barbets, Cuckoos, Parrots, Rollers, Bee-eaters, Kingfishers, Hornbills, Hoopoes, Trogons, Swifts, Nightjars, Frogmouths, and Owls.

Out of the 704 species and subspecies of the above families described in the 'Fauna of British India : Birds,' revised ed., accounts of the breeding of 545 are included in this volume. Of the remaining 159 the breeding of 61 has been recorded outside Indian limits, leaving 98 species and subspecies about whose breeding nothing is known.

The volume under review enumerates for each species the localities where it is known to breed, with details and descriptions of breeding sites. Nests are described fully, both as to position and structure, and the breeding season is indicated. Eggs are described as to number, shape, size, colour, and gloss. It gives, in fact, an accurate and concise account of practically all that is known on the subject, and brings our information up to date.

The investigation of the breeding habits of the Cuckoos has always presented a problem of special difficulty. The author, having made a special life-study of these birds, is in a position to speak with authority, with the result that the account of the breeding of the parasitic Cuckoos is remarkably complete—of the twenty-six species which occur in the Indian region the breeding habits of all but four are described.

It is pointed out by the author that several species of Cuckoo are known to lay two or more distinct types of egg. For instance, *Cuculus poliocephalus* lays either pure white eggs or chocolate. This would certainly seem to indicate two distinct races, which merit at least subspecific rank. It should be noted that the eggs of this Cuckoo are definitely white or chocolate, and no half-toned eggs are known to occur.

The work is nicely bound, and contains several good photographic illustrations: also a full index. It will be welcomed by all Indian bird-lovers. We now look forward to the issue of the fourth and last volume, which will complete the account of the breeding of Indian birds.

The Generic Names of British Insects.—Part 1. *Recommendations relating to the Publication of the Committee's Reports.* Price 6*d.* Part 2. *The Generic Names of the British Rhopalocera with a Check List of the Species.* Price 3*s.* 6*d.* The Royal Entomological Society of London, February 1934.

THESE are the first two instalments of an important work, the publication of which has been undertaken by the Royal Entomological Society of London, and the cost of which will be defrayed from a legacy bequeathed to the Society by the late Professor R. Meldola, F.R.S.

The first, as its sub-title indicates, deals with the recommendations to the Council of the Society respecting the reports made to it by its Committee on Generic Nomenclature. The more important part of the second report takes the form of an appendix to the first report of the Lepidoptera sub-committee, which deals in full with the generic names of the British Rhopalocera. This is the work of Mr. Francis Hemming, C.B.E., and it has manifestly involved a vast amount of original research into the literature and represents a very important contribution to the subject, on which the author is greatly to be congratulated. Though it may be optimistic to anticipate that it has finally resolved all the extremely controversial points that arise in connection with the generic names of British butterflies, it is greatly to be hoped that Editors as well as authors will agree to adopt the names here used, and that an approach may thus be made to the uniformity in nomenclature that is so essential to the subject.

The covering report of the Lepidoptera sub-committee recommends that the International Commission on Zoological Nomenclature should be requested to take the requisite steps for the following genera to be treated as *nomina conservanda*, viz., *Argynnis* Fab., 1807, *Vanessa* Fab., 1807, *Strymon* Hb., 1818, and *Colias* Fab., 1807. The report also includes a check list of the species, which should be of great value to collectors.

S. A. N.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

No. 80. AUGUST 1934.

XIV.—*Lower Palæozoic Brachiopoda of the Girvan District: Suggestions on Morphology in relation to Environment.* By Archie Lamont, M.A., B.Sc., Carnegie Research Scholar, University of Glasgow.

Lapworth's classification of the Ordovician and Silurian strata of the Girvan district, included within Sheets 7 and 8 of the Geological Survey one-inch Map of Scotland, may be summarized in the following table:—

Silurian	Penkill Group.
	Camregan Group.
	Saugh Hill Group.
	Mulloch Hill Group.
Ordovician..	Drummuck Group.
	Whitehouse Group.
	Ardwell Group.
	Balcletchie Group.
	Craighead Group (correlation disputed).
	Stinchar Group.

In recent re-examination of these groups attention has been concentrated upon many local unconformities and upon rapid and repeated changes in the conditions of sedimentation. On at least six horizons it is possible to examine the pæne-contemporaneous inhabitants of different facies of the same group. Thus in the Craighead Limestone we find two divisions *, which are distinct both in lithology and fauna: the lower is a massive limestone deposited in a clear sea; the upper, with transgressive base, is a shaly limestone. Each contains corals, either of different species or, at least, in different states of growth. Brachiopods in this instance are rare except in the upper division. In other groups, however, there are good examples of contrasting brachiopod faunas. The first notable instance is the Balcletchie Group, in which a conglomerate succeeds a mudstone. Similar contrasts may be obtained in the Whitehouse and Drummuck Groups, in which layers of sandy littoral material with shells—transported, it is thought, by tunamis or "tidal waves"—have been intercalated in fine sediments. In the Saugh Hill Group a gradation from limestone to shale provides another type of contrast, while additional observations have been made in the two highest groups.

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* Proc. Geol. Assoc. vol. xliv. pp. 84–86.

The present paper discusses certain typical and abundant—mostly Protremate—brachiopod species, which, from their field occurrence, must have lived in a muddy environment. It attempts to assess the adaptational value of some of the external features of these mud-dwelling forms, and contrasts them with the characteristics of sandy and clear-water contemporaries.

Considerable difficulty has been experienced. Local evidence is obscure regarding the life-position of brachiopod shells. Most at any rate of the fossil material considered in this paper lived within reach of currents, and, accordingly, has often been found in contradictory attitudes. Unfortunately, too, there is little published information bearing on the subject. Professor H. H. Swinnerton, in his 'Outlines of Palæontology,' has stated that "among Protremata and Telotremata the shell appears either to have remained erect or to have fallen over towards the dorsal side, so that the ventral valve came to lie uppermost" (1923, p. 89); but he does not insist on the absolute truth of his generalization, which, in the writer's opinion, is far too comprehensive. Davidson (1859) has argued from the principle of the economy of muscular effort that in the special case of certain Upper Palæozoic members of the family Productidæ Gray, where the concave dorsal valve is much the lighter, it must almost certainly have lain uppermost. He supports this view by analogy with *Ostrea* and other lamellibranchs, in which the valve in contact with the sea-floor becomes by far the more massive. The present writer agrees, pointing to the modern strophomenid genus *Thecidellina* Thomson, species of which live cemented by the ventral valve. The same view is suggested by the Carboniferous *Productus giganteus* Martin, which commonly occurs in large colonies with all the specimens resting on the convex ventral valve, as, for instance, in mine-roofs at Corrie in Arran, and by certain Lower Palæozoic examples to be considered in this paper. It is the writer's opinion that the superfamily Strophomenacea Schuchert is largely made up of genera which lived resting upon the convex valve.

In their 'Brachiopod Genera of the Suborders Orthoidea and Pentameroidea' Schuchert and Cooper make this statement: "When discussing or figuring the posterior of a brachiopod we place the ventral valve down, as this is the correct biological orientation of the living animal" (1932, p. 18). If this means, as it seems to convey, that all genera of Schuchert and Cooper's superfamilies Orthacea, Clitambonacea, Dalmanellacea, Syntrophiacea, and Pentameracea inclined during life to rest upon the ventral valve, it is, like the other generalization quoted, dangerously broad, and it is not documented by published evidence. A number of species belonging to these superfamilies will be discussed below. So far, however, the evidence regarding attitude in some cases falls short of being quite conclusive. It has therefore been thought best to begin by treating of examples belonging to the Strophomenacea, in which instance the fact that many genera lay upon the convex valve may be taken as established.

BALCLETCHIE GROUP.

A starting-point is provided by the following distinction. In the clear water of Stinchar Limestone * times at Girvan the shelly brachiopods, such as occur in considerable numbers, are biconvex and plano-convex.

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* The shelly brachiopods, which include many flattened and concavo-convex forms, found in the shaly limestone at Craighead, are left out of account for the present, partly because the correlation by Lapworth of the Craighead with the Stinchar Limestone is in dispute, and partly because fossil collecting at Craighead Quarry is now difficult and slow. The correlation difficulty will require treatment *in extenso*. The writer is inclined to regard the shaly limestone at Craighead as Upper Stinchar or immediately post-Stinchar Limestone in age.

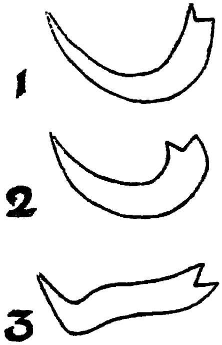
A typical example is the abundant *Orthis calligramma* var. *craigensis* Reed, from Bougang. At that locality the matrix in which the fossils are found indicates that this strongly ribbed plano-convex species lived in clear water on a sandy sea-floor. By contrast, in the succeeding mudstones of the Balcletchie Group, into which a number of Stinchar species survive, compressed and concavo-convex types of shell are in great numerical preponderance. Most of these belong to the Strophomenacea. But a concavo-convex member of the Orthacea, "*Plectorthis*" *ardmillanensis* Reed, gives a considerable number of specimens. It has other specialized features, which will be dealt with later (*vide infra*, p. 181). It would be easy to multiply examples of this decided change in morphology. A similar difference is also manifested between the faunas of the conglomeratic and argillaceous facies in the Balcletchie Group. This being so, it seems almost impossible not to correlate such morphological differences with influences due to the change in physical environment.

The Protremate species commonest in the Balcletchie mudstones are *Rafinesquina* (*Playfairia*) *semiglobosina* (Davidson), which is also found with rather stronger ribs in the Balcletchie conglomerate and at localities, *e. g.*, Bougang, in the Stinchar Group; *Rafinesquina ? subarachnoidea* Reed, a compressed form with "ears"; *Christiania tenuicincta* (McCoy); *Sowerbyella semirugata* (Reed); *Sowerbyella ? etheridgei* (Davidson); and *Leptelloidea llandeiloensis* (Davidson). The first and the last four species are all markedly concavo-convex (fig. 1, 1 & 2). One can picture shells with a contour such as theirs, resting upon the convex ventral valve on a muddy sea-floor. Often the concave dorsal valve would be covered with a film of silt, but it could be raised with little chance of any foreign material entering the shell. The broadly depressed surface would cause any detritus to slip off posteriorly towards the cardinal margin.

The mantle of a brachiopod has a marginal armature of setæ. In modern *Lingula* these have been observed erected along the lateral margins for the exclusion of sand and mud. It is natural therefore to believe that in Strophomenacea living on a muddy sea-bottom, and handicapped by their sedentary state, features of external morphology also should show adaptation for the exclusion of foreign material. Detritus, if it found entry in considerable quantity, might not readily be ejected.

The Strophomenacea in general have the pedicle much attenuated. It is often lost in the adult. This appears to have been the case in the predominant Balcletchie species. The pedicle became atrophied, and their concavo-convexity permitted them, as it were, to "float" on the muddy sea-floor. While the ventral umbo became increasingly incurved, the delthyrium, at least during the growing period of the shell, may have remained open. In several of the abundant compressed and concavo-convex species at Balcletchie laterally divergent rugæ appear intersecting the hinge-line. So far as the dorsal valve is concerned this modification would tend to direct away from the unclosed delthyrium the mud thrown off by the valve in opening. Such a view is suggested by species like *Rafinesquina* ? *subarachnoidea* and *Sowerbyella semirugata*. But a fuller demonstration of the point can be given from *Leptæna rhomboidalis* Wilckens—the most persistent of all the Girvan Brachiopoda. A primitive variety of this species (fig. 1, 3) occurs, but not in any number, in the Stinchar Limestone,

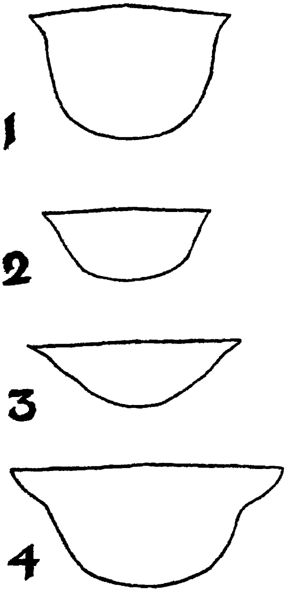
Fig. 1.



Outline sagittal sections of typical concavo-convex species of Strophomenacea in attitude assumed during life: (1) *Rafinesquina* (*Playfairia*) *semiglobosina*, × 1⅓; (2) *Sowerbyella* ? *etheridgei*, × 2; (3) *Leptæna rhomoboidalis* var. α Reed, × 2. All from the Balcletchie mudstones. (After Reed.)

in the shaly limestone at Craighead, and in the Balcletchie mudstones. This primitive variety shows the sudden geniculation of the valves characteristic of the group, and rugæ homeomorphic with those in the two species mentioned above. The primitive variety of *L. rhomboidalis*, however, does not have the wing-like outgrowths which are developed in most of the later varieties at the extremities of the long hinge-line. These outgrowths (fig. 2), it is suggested, arose in response to the necessity of warding off silt from the lateral edges of the opening shell. Similar auriculation is present in *R.* ? *subarachnoidea*, and was probably a factor in its successful struggle for existence. In this way concentric rugæ on concave valves and extensions of the

Fig. 2.



Outline diagrams of Strophomenacea, showing modification of cardinal extremities: (1) *Rafinesquina* ? *subarachnoidea*, $\times 1\frac{2}{3}$; (2) *Sowerbyella semirugata*, $\times 2$; (3) *Sowerbyella undulata* var. *tricostata*, $\times 2$; (4) *Leptæna rhomboidalis* var. ζ, $\times \frac{5}{6}$. (1) and (2) from the Balcletchie mudstones; (3) from shaly facies, Saugh Hill Group, Woodland Point; and (4) from impure limestone, Penkill. (After Reed.)

cardinal angles may be regarded as adaptations particularly useful when detritus was slipping off the surface of the upper valve.

A different suggestion must be made to account for corrugations on the lower valve. If we take *L. rhomboidalis,* we find that the concentric folds on the ventral valve are most pronounced at points immediately behind the line of geniculation. In this position no doubt they would help to maintain the stability of the shell on a muddy or sandy sea-floor. When the centre of gravity of the organism was changed and weight added posteriorly by the raising of the upper valve, these corrugations would be a means of preventing the ventral valve from sliding forward and sinking along the hinge-line. Such sinking, if it took place, might have allowed the ingress of foreign particles at the posterior angles. In some of the less transverse forms of *L. rhomboidalis* the rugæ are particularly strong on the lateral parts of the shell. The writer correlates this with the fact that the more equidimensional shells would have a greater tendency to upset in a sideways fashion. From this argument it will be seen that, while rugæ on the lower valve serve primarily to maintain stability, the final explanation lies in the principle of the exclusion of foreign material.

In corroboration of these views it may be pointed out that similar interpretations present themselves for external features in the developmental history of *Productus* J. Sowerby. The terminology employed by Miss H. M. Muir-Wood (1928) in describing the external morphology of certain groups of *Producti* would, with little modification, be equally appropriate to the many varieties of *L. rhomboidalis.* From the comparison of adults of different species of *Producti* it may be seen that the trend of evolution among these is from plano-convex to concavo-convex to geniculate, with even further developments. Geniculation appears rather late in Productid evolution, probably because its function of maintaining stability was to a great extent taken over by the early appearance of anchoring spines. In the diverse forms assumed by the varieties of *L. rhomboidalis* the influences which produced geniculation operated more quickly, and in all varieties, probably because of the non-appearance of such spines.

We may now consider the mud-dwelling Balcletchie species from another aspect. It is a striking fact that the abundant forms are characterized in most cases by thread-like striæ, and occasionally, as in an instance like that of *Sowerbyella* ? *etheridgei*, may even have a smooth exterior. Fine ornament appears to be an important feature in adaptation to a muddy environment. The fine striæ are normally radial, but an interesting exception is afforded by the numerous individuals of *Christiania tenuicincta*. Varieties of this species occur in the Girvan district with a long range in the Ordovician, but it reaches its greatest abundance in the Balcletchie mudstones. It is also common in the fine muds of the Drummuck Group at a new locality on the E. brow of Quarrel Hill, 680 yards S.W. of High Mains Farm. Its field relations prove that this species was highly successful in a muddy environment. It carries closely spaced concentric striæ on both valves. One may hazard that this arrangement of striæ points to a distinct trend of evolution. The concentric furrows would help to keep fine silt from moving towards the anterior part of the shell. But apparently they were not enough. So *C. tenuicincta*, like other Strophomenacea so far discussed, is concavo-convex.

In relation to the function in *Christiania tenuicincta* of the concave dorsal valve, structurally weakened by its concentric striation, it is noteworthy that on its inner side it has four girder-like longitudinal thickenings. Although doubtless these functioned as septa in connection with the inhalent and exhalent system, I venture to interpret them also as buttressing the thin dorsal valve. Such internal support is restricted to the valve, which from time to time had to throw off a load of silt; the highly convex and much thicker ventral valve had no need of reinforcement.

The compressed Strophomenacea, so common in shaly environments, have not yet been separately considered. Further reference to such forms will be made in discussing the shaly facies in the Saugh Hill Group at Woodland Point (*vide infra*, p. 177). An especially good example, from the Balcletchie mudstones, is *Rafinesquina* ? *subarachnoidea*, to three features of which attention has already been directed, viz., thread-like costæ, extended cardinal margin with sharply pointed "ears," and posteriorly divergent rugæ. An additional point is that the flattened nature of the valves would not favour the lodgment of detritus within the shell.

The Balcletchie mudstones, at Balcletchie, pass upwards into coarse sandstone and pebbly conglomerate with abundant matrix of greenish mud. Common species from the lower horizon persist, to some extent, into this higher division of the Balcletchie Group. The most notable of these are *Sowerbyella semirugata* and *Christiania tenuicincta*, the latter developing a rather massive ventral valve. But while such Strophomenacea continue into the Balcletchie conglomerate the fauna of this division is in great contrast with that of the mudstones. It is sufficient for the purpose of this paper to say that biconvex and strong-ribbed forms appear in force. Orthids are numerous. It is interesting to note also among strongly plicated forms that all three species of *Camerella*, described by Dr. Reed (1917) from the Balcletchie Group, come from the conglomerate. The same is true of the strongly costate *Rhynchotrema* ? *girvanense* Reed and *Zygospira orbis* Reed, and other species.

ARDWELL FLAGS AND WHITEHOUSE GROUP.

Peach and Horne (1899) mention that in the Ardwell flagstones, a slabby group of graptolitiferous sediments, there are narrow sandy layers containing an occasional brachiopod. The material of these layers it is now suggested was carried from a neighbouring coast-line and deposited by tunamis. This view is supported by Mr. S. M. K. Henderson's recent discovery of miniature breccia beds in the Ardwell Group. These he attributes to the effect of submarine earthquakes. My collection from the Ardwell littoral facies is not yet sufficiently large to be discussed, but this matter is mentioned because of the light which it throws on the origin of narrow, highly fossiliferous bands in the succeeding Whitehouse, Drummuck,—and possibly Mulloch Hill Groups.

The concentrated bands of broken shells, corals, and crinoids in the Whitehouse Group, at Shalloch Mill and Whitehouse Bridge, contain contrasting types of brachiopod. In this association *Nicolella actoniæ* Sowerby, with its very strong ribs, is an outstanding species, but individuals with fine radii are equally numerous. One is therefore inclined to think that the shells have been swept up from different types of environment. In the more shaly rock, close to the main bed of transported fossils at Shalloch Mill, one can obtain members of what appears to be a distinct fauna with predominating Dalmanellacea and Gasteropoda. Five specimens of the former were found, all with the convex ventral valve downwards. As collecting in this group is not easy further discussion of its fauna is postponed.

DRUMMUCK GROUP.

In the Drummuck Group, the topmost formation of the Ordovician at Girvan, four considerable faunal assemblages can be studied. A new locality, in very fine mudstone, is at present being examined. It is situated beside a small burn on the E. brow of Quarrel Hill, 680 yards S.W. of High Mains farmhouse, in a faulted strip of the Drummuck Group. It represents the lowest * horizon at which a large fauna can be collected. At this locality gasteropods and lamellibranchs share dominance with mud-dwelling species of brachiopod.

About 60 yards downstream from this Quarrel Hill locality, at a higher horizon, there is a bed of coarse shelly sand, 5 inches thick, the bottom half of which is crowded with a transported littoral fauna. This bed may be one of the "Starfish Beds" referred to by Lapworth (1882, p. 629) in a table of strata, but he makes no mention of it in describing the divisions of the Drummuck Group (pp. 617–621). The lithology and the occurrence of the fossils in this bed closely resemble these features in the well-known "Starfish Bed" on the S. bank of the Ladyburn. Both beds contain transported faunas, but the latter alone contains Asteroidea, so that the name "Starfish Bed" should be applied only to it.

The "Starfish Bed" proper occupies a rather high horizon in the Drummuck Group. It is of sandy facies, albeit with a proportion of finer material, and contains a remarkable concentration of fossil remains. The total thickness of the sandy bed, as exposed during recent

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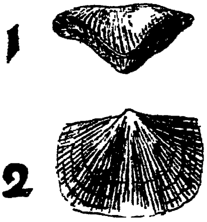
* Fossils found at a still lower horizon, in the grit at the base of the Drummuck Group, on Quarrel Hill, are not yet adequate for discussion.

digging, varied from 11 inches to 18 inches, and the stratum with fossils varied from 6 inches to half-an-inch. Such thinning of the "Starfish Bed," which was observed within a distance of 5 feet, may be regarded as evidence of its deposition by a tunami, and further indication to this effect is provided by the occurrence in it of a few cherty pebbles with rounded irregular angles. Such pebbles are quite foreign to the surrounding mudstones. Two of them, presumably brought from the sandy shore where the accompanying organisms originally lived, were found by Mr. J. L. Begg and the author in about 4 square feet of the bed—the one roughly 2½ inches by 2 by 1 and the other 1½ inches by 1 by 1.

Fig. 3.



Schizophorella fallax (Salter).

(1) anterior view, showing sinus and lateral lobes; (2) ventral valve, showing sinus, nat. size. From the "Starfish Bed," Drummuck Group. (After Reed.)

The fourth fossil locality to be discussed is that at South Threave farmhouse, in mudstones typical of the upper part of the Drummuck Group. At this locality we find gasteropods and lamellibranchs dominant, and only a few species of shelly brachiopod. Here conditions of life for the Brachiopoda, and even for the Mollusca, appear to have been distinctly adverse.

In the fine green mudstones on the E. brow of Quarrel Hill the Strophomenacea, as might be expected from our experience in the lower part of the Balcletchie Group, make up the bulk of the brachiopod fauna. *Eochonetes advena* Reed gives rise to the largest number of individuals. It is an early member of the family Productidæ, and assumes a moderately concavo-convex form. In the beds under discussion it occurs lying in different positions, so that here, as in the Balcletchie Group, even the finest muds must have been deposited within reach of wave movement sufficient to overturn empty shells. A variety of *Leptæna rhomboidalis*, large specimens of *Christiania tenuicincta*, and the finely ribbed *Strophomena valens* Reed are also very common.

The Orthoidea are represented by two plentiful species. The first of these is *Schizophorella fallax* (Salter) (fig. 3), also common in the "Starfish Bed," where, however, it averages a smaller size. It is a trilobed form, with a deep sinus on the ventral valve and corresponding fold on the dorsal valve, upon which the majority of the specimens are found resting. The abundant occurrence of such a form among mud-dwelling types calls for explanation. I believe that this will be found along the lines that such a trilobed brachiopod was adapted to life in currents, however slight *. Its shape probably caused it to wheel round, like a wind-vane, in a changing current. The pedicle end, if this view can stand, faced in the direction from which the prevailing current came. The lateral lobes would provide a shelter in the eddy behind which food particles would automatically collect. Excreta would be carried away by the stream of water directed through the sinus on the ventral—in this instance the upper—valve. This hypothesis is in keeping with Morse's description of the manner of ingress and exit of sea-water in *Lingula* (fig. 4): ". . . . the anterior border of the pallial membranes contracts in such a way as to leave three large oval openings, one in the centre and one on each side . . . . A continual current is seen passing down the side-funnels and escaping by the central one" (1878, p. 157). Orton (1914) believes that this is the general rule for most brachiopods, and sees in trilobation and bilobation the morphological result of lateral inhalent channels and a central exhalent channel. The writer goes a little further, in order to explain the success of *S. fallax*, and points out the possible advantages from sea-currents. The other member of the Orthoidea, occurring in abundance on the E. brow of Quarrel Hill, is *Parmorthis elegantula* var. *drummuckensis* (Reed), which here reaches a greater size than at South Threave.

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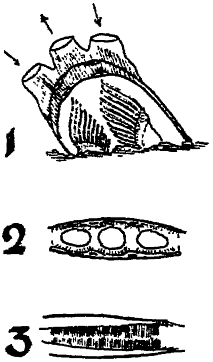
* Mr. R. Elmhirst points out to me the abundance of modern brachiopods in the strong currents of Loch Linnhe.

In the mudstones at South Threave, also laid down within reach of wave disturbance, only three species of brachiopod are at all common: these are *P. elegantula* var. *drummuckensis, Dayia cymbula* var. *girvanensis* Reed, and *Strophonella undata* (McCoy). The last belongs to the Strophomenacea, and its adaptation to a muddy environment can be understood without difficulty. The first two, however, take us into new ground. They are widely separate phylogenetically. The first is a Protremate, belonging to the Dalmanellacea; the second is a Telotremate, and attributed to the Spiriferacea Waagen. Yet the two species show a marked homeomorphy, in the broad shallow sinus, widening anteriorly, on the dorsal valve of each, in the bilobed appearance of the shells when viewed from the anterior, and in the subcarination of the ventral valves. If we omit the strophomenid these two species are the only representatives of the shelly brachiopods at all commonly found at South Threave. In such circumstances homeomorphic development in two species of such diverse descent almost certainly points to a common perfection of adaptation. The sinus probably served a similar purpose to that in *Schizophorella fallax.* Food-particles would collect in

Fig. 4.



Lingula lepidula Adams.

(1) setæ forming one exhalent and two inhalent tubes; (2) anterior view, showing position of tubes; (3) lateral view, showing setæ erected for exclusion of foreign material. (After Morse, 1902.)

the appropriate position with regard to the inhalent channels. The broad median sinus at the same time renders the dorsal valves of the two species almost concave. It is very inviting, on the analogy of the concavo-convex Strophomenacea, to regard these dorsal valves as adapted to the function of mud removal. If so, then *P. elegantula* var. *drummuckensis* * rested on its ventral valve and *D. cymbula* var. *girvanensis* did likewise. In support of this conclusion it may also be noted that in the interior of the ventral valves of both species there are localized thickenings which may have served as weights in maintaining the balance of the shell.

The species from the mudstones on the E. brow of Quarrel Hill and from those at South Threave serve to show us the types of the normal non-transported fauna of the Drummuck Group. Almost all the mud-dwellers tend to have relatively fine ribbing or a smooth shell. Among the plentiful species *Schizophorella fallax,* which also occurs in the "Starfish Bed," shows the strongest costæ. With this exception the mud-dwelling types are in striking contrast with the brachiopods in the layers of shelly sand. In the coarser material, biconvex and plano-convex, strongly ribbed, forms make an important appearance.

The lower half of the 5-inch bed of shelly sand on the E. brow of Quarrel Hill is crowded with small sharply ribbed species. These include strongly ribbed plano-convex "*Plectorthis*" *thraivensis* Reed and a considerable number of *Skenidium lewisi* var. *asteroidea* Reed. The latter is not common in other parts of the Drummuck Group. Most members of the genus *Skenidium,* it should also be noted, are rather more finely costate and prefer a muddy environment. Associated with the brachiopods there are numerous ossicles of crinoids, many stellate casts of which are beautifully preserved. On a superficial inspection these casts sometimes appear very like asteroids. Mr. J. L. Begg suggests that this may possibly have led to the bed being regarded as a "Starfish Bed" by Lapworth (1882, p. 629). In the circumstances it is proposed that this pseudo-Starfish Bed should in future be referred to as the "Crinoid Bed" of Quarrel Hill.

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* Under the variety *P. elegantula* var. *drummuckensis* Dr. Reed, if I interpret him aright, includes, as well as the nearly concavo-convex variety discussed, another torm, the dorsal valve of which is gently convex, with only a narrow median depression. This biconvex form is found in the "Starfish Bed" (sandy facies), but not at South Threave.

In the "Starfish Bed" proper strongly ribbed forms occur in force. Examples which provide large numbers of individuals are: "*Plectorthis*" *thraivensis*, plano-convex; *Dinorthis porcata* (McCoy), mostly plano-convex; *Glyptorthis crispa* (McCoy), biconvex; *Schizophorella fallax* (Salter), trilobed; *Nicolella actoniæ* var. *asteroidea* Reed, plano-convex. These shells have apparently been transported and concentrated together, but none are broken. On account of the transportation direct evidence of original attitude is not available, but indirect evidence may be adduced. Observations in some layers on the species mentioned showed about equal numbers in the case of each species resting upon the ventral and upon the dorsal valve. This was particularly true where the shells were most crowded together. But in other layers shells resting upon the convex or the more convex valve were seen to outnumber those resting upon the concave, flat, or less convex valve. The explanation of this seems to be that where the shells were least impinged upon by other shells they sank with the heavier valve downwards. Reverting therefore to a generalization of Davidson's (1859) argument, that the thicker heavier valve is that on which the organism rests, and applying this principle to the Orthoidea found in the "Starfish Bed," we take the interesting view that while species like *D. porcata* very probably rested upon the convex dorsal valve, a species like *N. actoniæ* var. *asteroidea* rested upon the thick convex ventral valve. We have already decided from other evidence that *S. fallax* lay upon its dorsal valve; the same is probably true of "*P.*" *thraivensis* and *G. crispa*, although these had valves not very unequal in weight. Different genera or families of the Orthoidea therefore adopted respectively different attitudes, some forms leaning over upon the dorsal valve and some upon the ventral valve.

The "Starfish Bed" also contains species of Strophomenacea, the common ones being a rather equidimensional variety of *Leptæna rhomboidalis*, and many specimens of *Sowerbyella thraivensis* (Reed). In the case of the former in some bands those found resting on the convex valve outnumber the others by two to one. In regard to

S. thraivensis, a very light shell, the evidence is highly contradictory. Fortunately we are already fairly certain that both rested on the convex ventral valve.

MULLOCH HILL GROUP.

It is not proposed in this paper to do more than mention the fauna of the Mulloch Hill Group. This group contains concentrated beds of shells up to several inches thick. These beds differ from the "Starfish Bed" and from other beds with transported faunas in the earlier groups in the important respect that, so far as the present examination has gone, the fauna which they contain is not distinguishable from that which comprises the isolated individuals in the body of the muddy Mulloch Hill sandstones. Observations on attitude, taken from the sporadic fauna, tend to confirm conclusions already indicated. A new observation here is that the globose *Whitfieldella angustifrons* (McCoy), belonging to the Spiriferacea, is found almost invariably resting on the convex dorsal valve. Taken in conjunction with the tentative conclusion regarding the variety of *Dayia cymbula* found at South Threave, this fact seems to indicate that in different members of the Spiriferaceæ we may expect to find the adoption of different attitudes.

SAUGH HILL GROUP.

Dr. Whittard (1932), working on the Valentian of Shropshire, has drawn up a table of fossils, showing those living in sandy beds, those living in shaly beds, and those found in both. In general, his conclusions regarding the genera and morphological types which show a decided preference for the one or other environment are not unlike those reached in this paper. Inflated, strongly costate orthids of the *calligramma* type are found by Whittard to prefer sandy beds, while fine-ribbed concavo-convex shells like *Sowerbyella* are recorded as typical in shales. Trilobed forms are found to thrive in both types of environment, and the same holds good of shells like *Parmorthis elegantula* (Dalman). Such a type, as I have pointed out (*vide supra*, pp. 173–174), possesses the adaptational advantages both of a trilobed form and of a concavo-convex form. Whittard's contrast, like those in the earlier part of this paper, is drawn between sandy and shaly faunas. From the Saugh Hill Group at Girvan we can go a step further, and demonstrate a contrast between a limestone fauna living in a clear sea and the fauna of a mudstone.

The Saugh Hill Group, where it outcrops on the south side of Woodland Point, 2½ miles S. of Girvan—the beds can be examined between tides,—provides a passage upwards from a limestone facies to a shaly facies. The shales end in a well-known graptolitiferous horizon. Within a few inches in the lower strata the brachiopod fauna can be seen to change entirely. The bands of pure limestone contain large biconvex shells, mostly smooth-shelled pentamerids, while the shale in part consists of layer after layer of compressed and concavo-convex forms. In the shaly facies the Damanellacea and Strophomenacea are particularly abundant. The light shells of the former superfamily must have been very liable to be overset, but those collected were found by a small majority to be resting with the convex ventral valve downwards. The same was found to be true of the small members of the Strophomenacea, such as *Leptelloidea scissa* O. T. Jones and *Sowerbyella undulata* var. *tricostata* (Reed). The abundant large Strophomenacea, mostly found resting on the ventral valve, are *Leptæna rhomboidalis* var. ϵ Reed, with large wing-like outgrowths at the cardinal angles, and *Stropheodonta jamesoni* Reed, a finely costate compressed species with strong divergent rugæ intersecting the cardinal margin. Also very common indeed is *Schuchertella pertinax* Reed, a member of the Strophomenacea, much compressed, and usually found resting on the dorsal valve, which in convexo-concave forms like *Schuchertella* and *Strophomena* is the convex valve. Trilobed forms are represented by fairly common *Atrypa imbricata* (Sowerby). This shaly fauna, which lived among silt in a sea with probably a good deal of fine muddy material in suspension, does not overlap, except in the case of a few individuals, with the fauna of the purer limestone beds.

A deduction from the dominant forms in this fauna is that extended cardinal margin and narrow body space are very common in a muddy environment. Long hinge-line implies the increase in length of the anterior and lateral margins. This means that the organism would collect food and oxygen from a greater water area.

The special significance of this adaptation can be understood when we realize, as is shown by H. B. Moore (1931, p. 328), that mud is an active oxygen absorber, and that therefore the water immediately in contact with a mud will be relatively oxygen-poor. The compressed nature of these brachiopods, it may be added, would at the same time lead to smaller requirements of food and oxygen.

That so many long-hinged forms lived among soft yielding muds seems fatal to C. E. Beecher's view (1901, pp. 77–78) that extended hinge-line originated in forms with short pedicle living attached to flat "objects of support." Different opinions on this question, including Orton's important contribution (1914), are discussed by Professor T. N. George (1933, p. 439).

The Woodland Point limestone was laid down in clear water on a sea-floor intermittently covered with a thin layer of mud. Its fauna comprises in principal *Stricklandinia lens* var. Reed, *S. lirata* var. *scotica* Reed, and *Barrandella undata* (Sowerby). These species sometimes occupy a band in the shaly facies, but when they do so they are usually unaccompanied by the normal shaly fauna. The mud in the case of such bands may have been very slowly deposited. The pentamerids in question appear to have been adapted to meet moderately muddy conditions, though not to meet such conditions as prevailed during the deposition of the normal shaly beds.

This view finds support in the fauna of the calcareous flagstones at Newlands farm, N. of Dailly. Here the three pentamerid species occur, though *S. lirata* var. *scotica* is not common, in association with species like *Leptelloidea scissa*, *Schuchertella applanata* (Salter), and *Cœlospira scotica* var. Reed. The facies and fauna at Newlands may be described as intermediate between the extremes found at Woodland Point. Thus at Newlands a typical shaly species like *Stropheodonta jamesoni* is altogether absent, and the predominant *Schuchertella pertinax* of Woodland Point is extremely uncommon, being replaced by another member of the genus, *i. e.*, *S. applanata*, which has coarser ribs and was doubtless more adapted to clearer water in a sandier environment. The intermediate nature of the Newlands lithology and fauna brings out with greater clarity, if that is possible, the sharp faunistic division seen at Woodland Point,

CAMREGAN AND PENKILL GROUPS.

Of the succeeding Camregan and Penkill Groups it may be briefly noted that a contrast, which provides little fresh information, may be drawn between the *Rhynchonella*-Grits, at the base of the Camregan Group, and the Upper *Pentamerus*-Limestone. The names given by Lapworth are equally significant of the faunistic and of the lithological difference. The limestone is a muddy one—although the water in which deposition took place would be much clearer than that in the case of the average mudstone—and contains such characteristic muddy forms as *Sowerbyella penkillensis* (Reed), *Leptæna rhomboidalis* var. ζ Reed, and abundant *Atrypa reticularis* Linnæus. The last has a flattened upper valve with median sinus, so that it possesses double advantages—firstly, for the removal of mud from the opening shell, and, secondly, in its adaptation to collect food from currents.

The gradation between the typical faunas of limestone, muddy limestone, and shale is undoubtedly of great importance. It is a pity that there is no further evidence to draw upon in the Girvan district. Rate of sedimentation, especially in the case of fine material which remains long in suspension, must often exercise a decisive influence upon fauna. More information on this problem may probably be looked for from the limestones and shales of E. Shropshire.

CONCLUSIONS.

From the evidence of the Girvan forms discussed in this paper, and in spite of the difficulties caused by the fact that they all appear to have lived within reach of wave action, we may conclude that there is a general tendency for shelly brachiopods to rest upon a convex valve; in most of the species discussed that valve is the more heavily developed. In the Orthoidea the conclusion is that some genera rested upon the ventral valve, *e. g.*, *Nicolella*, and others upon the dorsal valve, *e. g.*, *Dinorthis*, *Schizophorella*. In many cases the empty shells were so subject to be overturned that direct evidence of attitude is not very reliable; nevertheless, adaptations, apparently for mud removal and feeding, make it almost certain that species like *Parmorthis elegantula* (Dalman) lay upon the ventral valve. The Strophomenacea in general had the convex ventral valve downwards; this is true of *Sowerbyella*, *Leptelloidea*, *Leptæna*, *Rafinesquina*, *Stropheodonta*, *Christiania*, *Chonetes*, etc., but *Strophomena* and *Schuchertella* rested upon the convex dorsal valve.

As regards the advantageous types of external morphology for different environments very definite conclusions have been arrived at. In muddy surroundings we find the greatest abundance of compressed and concavo-convex forms. These are usually characterized by fineness of radii, often by rugæ, and often by acutely pointed cardinal angles. Clear water and a sandy sea-floor tended to yield biconvex and plano-convex coarsely ribbed, or at least thick-shelled, types of brachiopod. In a clear sea, where sedimentation was slow, as may be indicated by the occurrence of pure limestones, biconvex smooth forms found their most suitable environment *.

NOTE ON EXTERNAL RIBBING.

A note on external ribbing may now be added. The most primitive brachiopods were externally smooth-shelled. Ribbing may be regarded as the product of an anagenetic process of evolution, while by catagenesis a form which has come to possess ribs may lose them. We are now in a position to consider the influences which bring about the appearance and disappearance of ribs. We may recall a suggestion which was made by Davidson in discussing the external ornament of *Rafinesquina* (*Playfairia*) *semiglobosina*: "The nature of the bottom of the sea may have a good deal to do in relation to the coarseness or fineness of the radii. Where the sea-bottom was composed of a fine muddy substance, such as was the case at Craighead, the sculpture of the shell was finer and more delicate, while where the bottom was made up of a coarse material such as at Balcletchie (conglomerate) the ribbing became coarser" (1883, p. 196). This surmise from the consideration of one species leads up to the present writer's position, which has been reached after an examination of the typical

* If it is objected that biconvex strong-ribbed forms are common in limestones such as the Wenlock Limestone, it may be replied that such strong costation adapted its possessors to life among shelly débris of which such limestones are often largely composed (*vide infra*, p. 181).

brachiopods found in different facies at many horizons and localities.

The evidence now available from Girvan shows that strong ribbing is commonest in shells inhabiting a sandy environment. Examples are given from the "Starfish Bed," and other sandy faunas have been mentioned. On the other hand, thread-like ribbing is characteristic of the dominant species in the very fine mudstones; or in the mud-dwelling species, where the radii are comparatively pronounced, as, for instance, in "*Plectorthis*" *ardmillanensis*, there is a fine striation longitudinally between the ribs and also a fine transverse striation. It is perhaps not too hazardous to speculate that if the descendants of such a shell continued, for a sufficiently long time, to live in an environment of fine mud the trend of evolution would be to eliminate the stronger ribs. At least, that is the conclusion from the observed instances of ribbing in the forms which are proved by their plentiful occurrence at muddy horizons to be specially adapted to that type of environment.

While we see a few pronounced ribs developed under muddy conditions in, for example, some species of *Sowerbyella*, probably for the sake of greater strength, there is good reason for suggesting that consistently strong external ribbing develops exclusively in relation to life on a rough-sandy coast or among other coarse fragmentary material. A finely ribbed shell would not be very stable if resting on a sand in which the diameters of the grains were greater than the intercostal furrows. It seems likely that there is a correspondence between the grain-size of the environmental material and the calibre of the ribs. Ribbing, while it is a means towards increased rigidity, is also, the writer believes, an important factor in maintaining stability. This view finds support from the argument already advanced regarding the function of rugæ on the downward valves of many species of Strophomenacea. The relative advantage, in a variety of environments, to forms like *Leptæna rhomboidalis*, which has coarse rugæ superimposed upon fine radii, can also be readily imagined.

This new theory is quite consistent with the theory, first advanced by Morse (1871, p. 33), that external ribbing, which corresponds to internal furrowing, is in the brachiopod induced and guided by setæ given off along the anterior and lateral margins of the mantle (fig. 5). Such setæ, we know from modern forms, also serve to exclude foreign material. Naturally, therefore, they tend to be finer and closer together in mud-dwelling species, and so give rise to fine closely spaced radii.

The extension to the Lamellibranchia of the view that the early evolution of ribbing is conditioned by the grain-size of the environment may be possible. So far as the Girvan district is concerned, the Drummuck mudstones at South Threave are typical of an environment in which the dominant lamellibranchs have fine concentric ridges. These furrows would doubtless give greater stability. They would prevent the fine silt from moving towards the ventral line, while not hindering water from so moving and entering between the valves, and would cause a "draining" of the sand nearest the shell. Thus they would ensure a firm contact with the material among which the shell lived. The best examples of very strongly radially ribbed lamellibranchs are found chiefly among the coarse débris of the Whitehouse Group and in the "Starfish Bed." At the latter locality the strong-ribbed *Byssonchia radiata* (Hall) is strikingly abundant. This species appears to prefer a sandy environment, and, though byssiferous, it is probable that its coarse ribbing arose, in a free ancestor, in association with such surroundings. The ribs, once evolved, probably remained for the sake of structural rigidity, but they may have continued to some extent

Fig. 5.

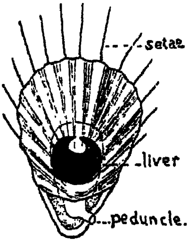

Diagram of young *Terebratulina septentrionalis* (Couthouy), actual length 2 mm., showing ribs corresponding to position of setæ. (After Morse, 1871.)

to serve their original function, especially if the shell tended to lie over upon one valve. It is inferred, therefore, that a study of the Lamellibranchia would, at least in some measure, support the general view advanced in this paper regarding the influence of environment upon the evolution of external ribbing.

ACKNOWLEDGMENTS.

I wish to put on record my extreme indebtedness to Mr. J. L. Begg, who placed his extensive field experience of the Girvan district at my disposal. Many thanks are also due to Professor E. B. Bailey, Dr. John Weir, and Mr. R. Elmhirst for constructive criticism and suggestions, and to Miss H. M. Muir-Wood for facilities in consulting the Gray Collection at South Kensington. For help during part of the field-work I am indebted to the Rev. J. M. Ewing, Arbroath, and for similar assistance and the donation of specimens to Mr. T. MacTaggart, Dailly.

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XV.—*Descriptions of new Genera and Species of African* Aleyrodidæ. By HERBERT L. DOZIER.

[Plates IV. & V.]

APART from the four inadequately described East African species given in Newstead's short paper in Mitteil. aus dem Zool. Mus. Berlin, vol. v. pt. 2, 1911, little is known of the Aleyrodidæ or whiteflies of Africa, although they number among them some very serious pests. The present paper describes two new genera and nine new species, and is made possible through the kindness of Mr. J. Ghesquière of the Belgian Congo and Mr. H. Hargreaves, Government Entomologist for the Uganda Protectorate of British East Afirca, who forwarded the material for study.

The type slides of the new species described are deposited in the British Museum, and where the series permits co-type slides are to be deposited in the collection of the U.S. National Museum, the writer, and Mr. Ghesquière.

The Indian *Aleurodes simula*, described by Peal (Journ. Asiatic Soc. Bengal, vol. lxxii. p. 81, 1903), and placed by Quaintance and Baker with doubt in *Aleurolobus*, most likely belongs to the new genus *Africaleurodes*. The species was said to be very abundant on the simul-tree, *Bombyx malabaricum*, at Calcutta.

Aleurolobus hargreavesi, sp. n.

This species is very closely allied to the sugar-cane pest, *Aleurolobus barodensis* (Maskell), but is readily distinguished by the difference in the abdominal segments and in the amount of wax excretion. *A. barodensis* has the dorsum covered with chalky-white wax-meal, which is not present in *hargreavesi*. The pupa-cases are placed lengthwise on the blades of grass and are very conspicuous.

Pupa-case.—Length 1·78 mm.; greatest width 0·96 mm. Of such a dense black that it has to be cleared to distinguish the details. Shiny black in colour, with a narrow prominent white wax fringe. Elongate-elliptical in outline. Submarginal area with suture-like markings that extend from the outer margin mesad; the margin dentate, with very shallow rounded incisions; body-segments are very distinct and readily distinguish this species from the other described members of the genus. The transparent lunar "eye-spots" and tracheal pores on margin, so characteristic of this genus, are not discernible in this species. Vasiform orifice subcordate in outline, with the surrounding area typical of the genus; the operculum obscures the lingula and occupies most of the orifice (Pl. IV. fig. *c*, *d*).

Described from abundant material collected by H. Hargreaves (no. 0182) on an undetermined grass at Kampala, Uganda, February 16, 1928. The species is parasitized by an undescribed species of *Encarsia*.

Aleuroplatus andropogoni, sp. n.

Pupa-case in specimens at hand without wax excretion.

Pupa-case.—Length 1·12 mm.; greatest width 1·00 mm. Dark brown to black. General outline oval, slightly pointed anteriorly and slightly but distinctly constricted in the region of the "eye-spots." The margin distinctly differentiated, composed of shallow bluntly rounded teeth. Abdominal segments distinguished narrowly along the middle only; abdomen separated off from the thorax, the suture separating them curving upwards distinctly laterally and then cephalad almost to the margin of case. Reniform "eye-spots" very distinct. Dorsum with variable pigmentation, without spines, but with a pair of very minute clear circular pores on disk of thorax. Vasiform orifice very small, the inner margin apparently armed with teeth. In the poor specimens available the thoracic and caudal tracheal folds do not appear to be differentiated. On account of its shape, colour, and "eye-spots" this species could easily be mistaken for an *Aleurolobus*, but the vasiform orifice is not surrounded by a definite trilobed figure as in that genus.

Described from two pupa-cases collected by J. Ghesquière on a grass belonging to the genus *Andropogon* at Lodja, Belgian Congo, October 1929.

Tetraleurodes ghesquierei, sp. n.

Pupa-case.—Length 0·72 mm.; greatest width 0·52 mm. Apparently without any wax excretion. Deep black in colour, but mounted in balsam and examined under the microscope the pupa appears light brown, with the submarginal area, which is set off by a very distinct suture, much darker, and a pair of distinct "eye-spots" present on the cephalic end of the case. Oval in outline, the margins distinctly dentate; the dorso-median and transverse sutures very distinct, those of the abdomen less so; the transverse suture turns very distinctly anteriorly, but does not reach the submarginal suture; a row of three very small dark pores is present anterior to the transverse suture on each side of the dorsum. The most striking characteristic of the species is the very distinct furrow across the disk of the dorsum just anterior to the transverse suture. This furrow, under a high power of the microscope, appears to be roughly toothed or ridged along the sides. Vasiform orifice small, subcircular. (Pl. IV. fig. *e*).

Described from two pupa-cases, mounted in balsam on separate slides, collected by J. Ghesquière on *Periploca* *nigrescens* at Barumbu Plantation, Belgian Congo, August 1925.

Neomaskellia bergii (Signoret).

Kampala, Uganda, 1928; all stages present on the grass *Penecœtum arvensis* (H. Hargreaves).

Genus AFRICALEURODES, nov.

Very closely allied to *Aleurolobus* Q. & B., but lacking the reniform "eye-spots" and opacity of that genus. Also resembling *Dialeurodes* Cockerell, but separated immediately by having the central or discal portion set off or differentiated by a very distinct suture-like line. In addition, the narrow submarginal area is differentiated by a faint line. Pupa almost flat, subcircular to elliptic in outline, varying from a pale almost translucent colour to having the entire discal area reddish orange. Dorsum without papillæ or large pores, but very minute circular pores often present; tracheal folds scarcely discernible, the pores terminating on margin of case in a few teeth; vasiform orifice subcordate, faintly toothed on lateral and caudal margins; operculum covering about half of the orifice, the lingula rather long, with its distal extremity visible caudad of operculum; the orifice surrounded with a more or less distinct trilobed figure similar to *Aleurolobus*, the lobes forming a channel from the orifice caudad to margin of the case, terminating in indistinct teeth. The case, so far as known, is without waxy excretion.

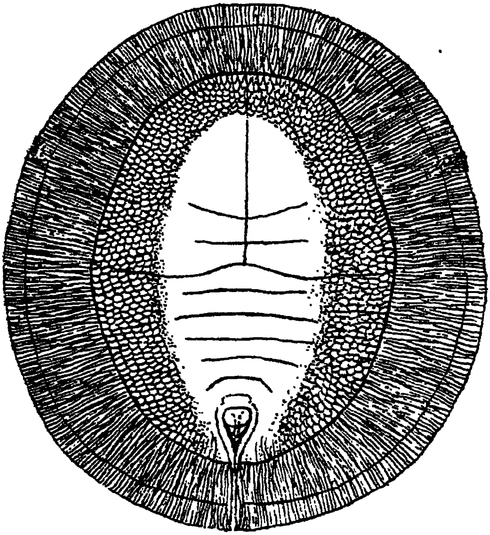
Genotype: *Africaleurodes coffeacola* Dozier.

Africaleurodes coffeacola, sp. n. (Text-fig. 1.)

Readily distinguished by its pale translucent colour.

Pupa-case.—Length 1·46 mm.; greatest width 1·28 mm. Lying closely appressed to lower leaf-surface and without a waxy excretion. Subcircular or broadly elliptic in outline, the margin dentate. The dorsal disk differentiated by a very distinct suture-like line, the anterior outline of this discal area somewhat rectangular, with the margins reticulated indistinctly. The body-segments are distinct on the dorsal disk and a number of very minute circular pores can be seen under the high power of the microscope; the narrow submarginal area is faintly indicated and an irregularly placed row of very minute circular pores follow around just outside; the area outside of the delimited dorsal disk is indicated by numerous very faint, irregular, and oft-interrupted striations or lines. Vasiform orifice subcordate, the operculum covering about one-half of the orifice, the lingula rather long and clearly visible, extending beyond the operculum. The trilobed figure surrounding the orifice present, and a distinct channel runs from the orifice caudad to the margin, where it terminates in indistinct teeth.

Text-fig. 1.



Pupa of *Africaleurodes coffeacola*, sp. n.

Described from numerous pupa-cases, collected by J. Ghesquière in abundance on the lower surface of leaves of *Coffea robusta* at Lodja, Belgian Congo, March 1928.

Africaleurodes ochnaceæ, sp. n.

Closely allied to *A. coffeacola* Dozier, but slightly more elliptical in outline and with the radial striations or lines more prominent and distinct.

Pupa-case.—Length 1·50 mm.; greatest width 1·38 mm. Apparently without waxy excretion. General outline elliptic, flat, the margin dentate. Dorsal disk distinctly differentiated by suture-like line and having a somewhat granular appearance, the anterior outline of dorsal disk somewhat rectangular. Colour pale translucent, but the markings appearing darker and more distinct than with *A. coffeacola.* Under high power of the microscope the granular appearance of the dorsal disk and the interrupted irregular radial lines of the outer portion are shown to be due to groupings of extremely minute circular pores. Vasiform orifice subcordate, but less elongate than in *A. coffeacola* (Pl. IV. fig. *a*).

Described from four slides containing pupa-cases collected by J. Ghesquière on foliage of *Ochna* (Ochnaceæ) in damp forest at edge of stream, Kole (River Lukenie), Belgian Congo, Jan. 8, 1928.

Africaleurodes loganiaceæ, sp. n.

Distinguished immediately from *A. coffeacola* Dozier and *A. ochnaceæ* Dozier by the reddish-orange colouring of the dorsal disk.

Pupa-case.—Length 1·40 mm.; greatest width 1·20 mm. Without waxy excretion. Broadly elliptical in outline, flat, margin dentate. General colour pale yellowish translucent, distinctly denser than in either *A. coffeacola* or *A. ochnaceæ*, the dorsal disk entirely, and along each side very conspicuous and distinct, reddish orange. The radial lines of the two above-mentioned species are indicated in *A. loganiaceæ* by a deepening of the colouring. Tracheal folds discernible in this species and terminating on margin of case in a distinct pore. There are four irregular longitudinal rows of very minute circular clear pores on the dorsal disk and a row of widely spaced similar pores following around its outline just inside of the suture-like demarcation. Vasiform orifice subcordate, the operculum covering about half of the orifice, the distal extremity of the lingula clearly visible caudad of the operculum (Pl. IV. fig. *b*, and Pl. V.)

Described from numerous pupa-cases collected by J. Ghesquière on a plant belonging to the family Loganiaceæ at Sankuru, Belgian Congo, January 1928. The species is very heavily attacked by an undetermined fungus.

Aleurotrachelus africanus, sp. n.

Pupa-case.—Length 0·78 mm.; greatest width 0·54 mm. Dark brown to black in colour, with a marginal fringe of white wax. The margin dentate, with the incisions very shallow and rounded. Dorsum without pores of any kind, the body-sutures very distinct, a prominent fold on each side of the dorsum in the upper half, and along the median line of the dorsum a prominent tracheal-like ridge, very characteristic of the genus, terminating caudad by surrounding the vasiform orifice. Vasiform orifice rather large, subcordate in outline; the operculum and lingula very rudimentary and occupying only a very small part of the orifice (Pl. IV. fig. *f*).

Described from abundant material collected by J. Ghesquière on *Desmodium* sp. at Barumbu, Belgian Congo, January 1926 (no. 593). This species was very heavily attacked by a species of fungus, kindly determined by Dr. T. Petch as *Aschersonia hypocreoides* (Cke. & Moss.). One pupa-case contains a pupa of an Aphelinid parasite.

Genus CORBETTIA, nov.

Pupa-case rather elongate-elliptical, the margin toothed. Tracheal folds or pores absent. The dorsal area with characteristic chain of small pores on each side. Submarginal area provided with prominent setæ. Vasiform orifice subcordate, the lingula partially exposed, the posterior margin more or less distinctly toothed.

Genotype: *Corbettia millettiacola* Dozier.

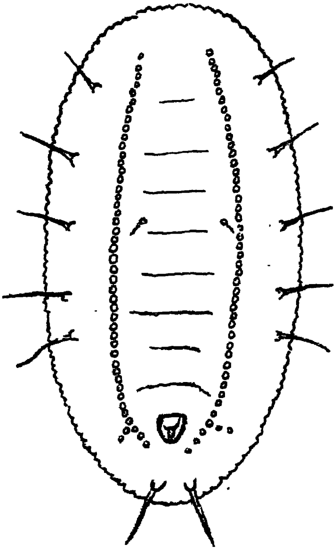
The genus is named in honour of G. H. Corbett, Government Entomologist, Straits Settlements and Federated Malay States, who has contributed much to our knowledge of the Aleyrodidæ of Ceylon.

Corbettia millettiacola, sp. n. (Text-fig. 2.)

Pupa-case.—Length 0·86 mm.; greatest width 0·44 mm. Pale yellowish in colour, without wax excretion apparently, and rather inconspicuous on the leaf. Elongate-elliptical in outline, the margin dentate. Abdominal sutures visible and a characteristic row or chain of small more or less circular pores running nearly the entire length of the case on each side. There are very prominent spines or setæ arranged inside the margin—four on each side, a pair on the anterior portion, and a pair near the caudal end. One pupa-case bears a small pair of setæ on the disk, and these appear easily broken off. Vasiform orifice subcordate, the posterior margin very indistinctly toothed; the operculum filling about half of the orifice, the lingula partially exposed and without setæ.

Described from five pupa-cases, mounted in balsam on two slides, collected by J. Ghesquière on *Millettia* versicolor, a leguminous shrub, at Kole (Sankuru), Belgian Congo, Jan. 22, 1928. Two of the pupa-cases contain pupæ of a small chalcid parasite. It is interesting to note that the genus *Millettia* is reported to contain rotenone, the most potent insecticidal constituent of Derris.

Text-fig. 2.



Pupa of *Corbettia millettiacola*, sp. n.

Aleyrodes periplocæ, sp. n.

Pupa-case.—Length 0·92 mm.; greatest width 0·62 mm. Almost flat, subelliptical in general outline, the cephalic end obtusely rounded, the lower third of the lateral margins angled to rather truncate caudal margin. No tracheal folds discernible. Margin of case with very distinct double row of blunt teeth and with no submarginal area separated from the disk. Two pairs of very minute and inconspicuous setæ are present in some specimens on the anterior and middle portions of the dorsal disk. Vasiform orifice relatively small, bluntly subcordate, the cephalic margin straight, the operculum occupying two-thirds of the orifice, the lingula distinctly visible caudad of the operculum. A pair of minute setæ latero-anteriorly of the orifice. The pupa-case is bordered with a copious white wax fringe that radiates out in long arms or lobes. In balsam the pupa-case appears pale translucent yellowish.

Described from numerous pupa-cases collected by J. Ghesquière in abundance on leaves of *Periploca nigrescens* at Barumbu Plantation, Belgian Congo, August 1925. One pupa-case contains the pupa of a parasite, easily identified by its antennæ as a male *Eretmocerus* sp.

EXPLANATION OF THE PLATES.

Plate IV.

Microphotographs of: *a*, pupa of *Africaleurodes ochnaceæ*; *b*, pupa of *Africaleurodes loganiaceæ*; *c*, pupæ of *Aleurolobus hargreavesi* on blade of grass; *d*, pupa of *Aleurolobus hargreavesi*; *e*, pupa of *Tetraleurodes ghesquierei*; *f*, pupa of *Aleurotrachelus africanus*. All greatly enlarged.

Plate V.

Microphotographs of: *a*, pupæ of *Africaleurodes loganiaceæ*, closely appressed to lower leaf-surface; *b*, pupæ of *A. loganiaceæ* attacked by fungus; *c*, part of the former enlarged, showing normal pupæ of *A. loganiaceæ* and others attacked by fungus.

XVI.—*Notes on Diplopoda*—I. *The Re-study of a widely distributed British Millipede,* Ophyiulus pilosus (*Newport*).

By Sholto W. Rolfe, B.Sc. (Agric.), Dip. Agr. (Wye), Department of Zoology and Geology, S.E. Agricultural College (University of London), Wye, Kent.

Ophyiulus pilosus (Newport, 1842) is a fairly common British millipede. At Wye, Kent, where it has been taken repeatedly under plant débris, both sexes occur in about equal numbers. As this species has not been fully described in English the writer takes this opportunity of giving the following account from his own material.

External Characters : General.

The animal is slender and shiny, being brownish black or black in colour, and commonly varies in length from 19 to 19·5 mm. in the male and from 23 to 26 mm. in the female. The body is well covered with long bristles, which, however, are more sparsely distributed towards the anterior end (figs. 1 & 2). The dorsal part of the last

Fig. 1.

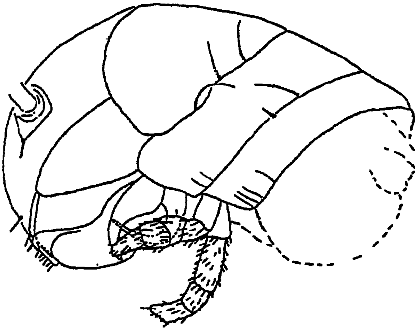


Fig. 2.

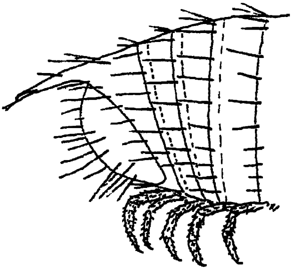
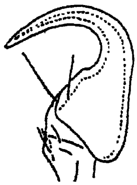


Fig. 3.



Ophyiulus pilosus (Newport), ♂.

Fig. 1.—Head, showing also first (modified) and second pair of legs. (Ocelli omitted.) Spec. 12. × c. 30.
Fig. 2.—Posterior extremity, showing tail. Spec. 12. × c. 25.
Fig. 3.—Modified first appendage, right side. Slide 35. × c. 70.

tergum is continued posteriorly to form a long tail liberally covered with long bristles and ending in a fine almost transparent point (fig. 2). The animal is very active, and usually wriggles violently when handled, seldom rolling into the quiescent spiral typical of many Iulids.

Colour, Sculpture, etc.

(Description of a male freshly killed in hot water.)

The ground-colour of the dorsal part of the body is very dark brown, and this is regularly mottled with markedly lighter brown, small subcircular patches, more especially towards the sides. This lighter brown prevails on the underpart of the body and over all of the last two segments. The head and first segment are also lighter in colour and have finer mottlings. The legs are whitish and very hairy. The prozonites are smooth, with a few very fine antero-posterior grooves towards the posterior edges. The metazonites are stouter, with deep, evenly spaced, antero-posterior furrows, extending nearly their whole length. At the posterior edge of the metazonite there is a narrow margin with much smaller and closer antero-posterior grooves. The bristles are situated on little knobs arising at the posterior edge of the deeply grooved part of the metazonite, and are arranged in regular antero-posterior rows. They are usually a little longer than the metazonite. The head and first segment have only a few faint, short, antero-posterior grooves. The last three segments are legless.

Measurements.

The male is somewhat the smaller animal, as is shown by the following figures :—

Specimen (11), ♂, 19·0 mm. long, 1·19 mm. wide.
,, (12), ♂, 19·5 ,, ,, 1·19 ,, ,,
,, (17), ♂, 19·0 ,, ,, 1·15 ,, ,,
,, (17) had 52 body-segments.

Specimen (14), ♀, 23 mm. long, 1·33 mm. wide.
,, (19), ♀, 25 ,, ,, had 53 somites.
,, (20), ♀, 25 ,, ,, ,, 54 ,,
,, (21), ♀, 25 ,, ,, ,, 52 ,,
,, (22), ♀, 25 ,, ,, ,, 54 ,,

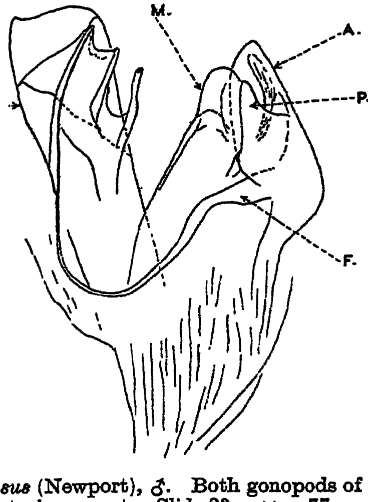
Ocelli.

These are quite distinct and easy to count. They project externally as hexagonally bordered elevations almost black in colour, and giving in some lights a honeycombed appearance. They are arranged regularly within an equilateral triangle, one apex of which points forwards to the base of the antenna. Occasionally some of the rows of ocelli are not complete, but this does not usually affect the arrangement of the others.

In parallel rows from the base of the antenna the following were counted :—

Specimen (11), ♂.	Left.	2, 3, 4, 5, 6, 7, 8, 9	=44.
	Right.	Ditto.	=44.
,, (12), ♂.	Left.	3, 4, 5, 6, 7, 8, 9	=42.
	Right.	Ditto.	=42.
,, (15), ♂.	Left.	2, 3, 4, 5, 6, 7, 8, 9	=44.
	Right.	1, 3, 4, 5, 6, 7, 8, 9	=43.
,, (19), ♀.	Left.	2, 3, 4, 5, 6, 7, 8, 8	=43.
	Right.	Ditto.	=43.
,, (20), ♀.	Left.	2, 3, 4, 5, 6, 7, 8, 7	=42.
	Right.	1, 2, 3, 4, 5, 6, 7, 8, 9	=45.
,, (21), ♀.	Left.	1 (3+1 smaller), 4, 5, 6, 7, 8, 8	=43.
	Right.	2, 3, 4, 5, 6, 7, 8, 7	=42.

Fig. 4.



Ophyiulus pilosus (Newport), ♂. Both gonopods of right side, interior aspect. Slide 23. × c. 77.

A., anterior gonopod ; *P.*, acute process ; *F.*, flagellum ; *T.*, posterior gonopod (telopodite) ; *M.*, " middle-plate."

Fig. 5.

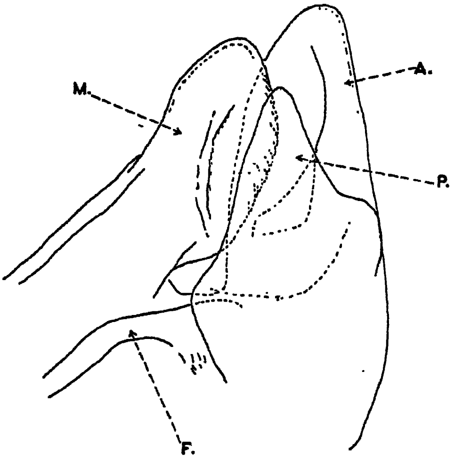
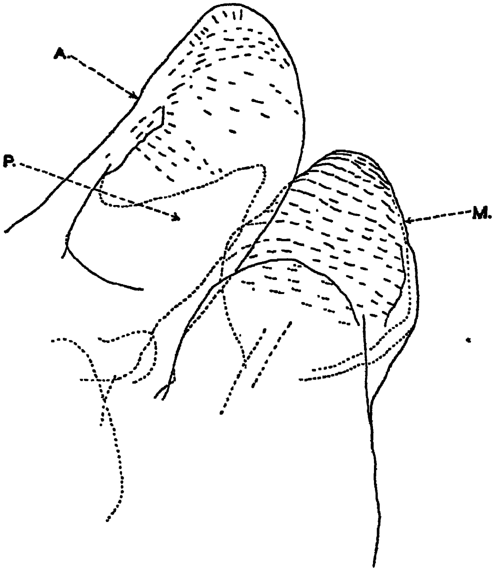


Fig. 6.



Ophyiulus pilosus (Newport), ♂.

Fig. 5.—Anterior gonopod and "middle-plate"; internal aspect. Slide 23. × 210.

Fig. 6.—Anterior gonopod and "middle-plate," exterior aspect. (The middle-plate is turned, giving anterior view.) Slide 20. × 212.

Lettering as in fig. 4.

MALE.

In the male the first pair of appendages, *i. e.*, the appendages of the second segment, are modified to form a pair of small, pointed, sickle-shaped organs which are used as claspers (figs. 1 & 3).

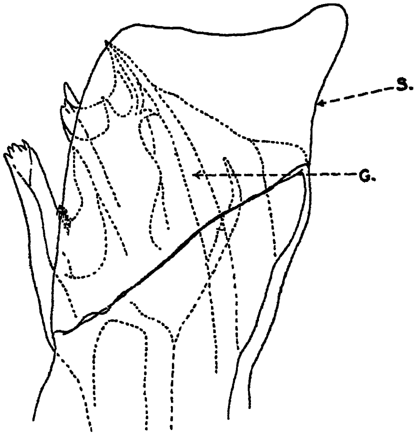
Gonopods. (Fig. 4.)

The posterior gonopods are longer than the anterior pair and stand well away from them at an angle.

Anterior Gonopod. (Figs. 5 & 6.)

The anterior gonopod is in the form of a plate (*A.*) somewhat concave posteriorly; it has an acute process (*P.*) arising internally from its base. Between the plate (*A.*) and its process fits the coxal process (*M.*) of the posterior gonopod (the middle-plate or "Mittelblatt" of Attems, 1926). The plate (*A.*) is somewhat thickened on its anterior edge and has numerous short striations towards its distal end. Near the base of the anterior gonopod a flagellum (*F.*) articulates with it. The flagellum passes back and along a groove in the posterior gonopod.

Fig. 7.

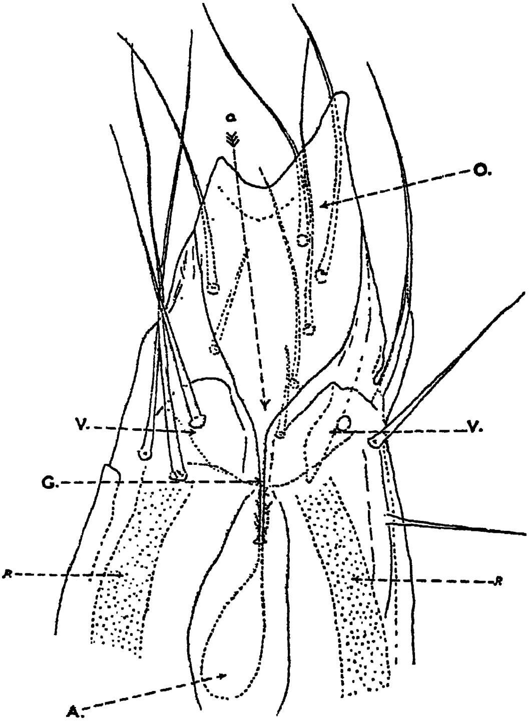


Ophyiulus pilosus (Newport), ♂. External aspect of posterior gonopod, showing shield-plate (*S.*) and groove for flagellum (*G.*). (Anterior to the left.) Slide 22. × 215.

Posterior Gonopod. (Figs. 5, 6, & 7.)

This is elongate and subrectangular. From the base arises a process, the middle-plate (*M.*), which is associated with the anterior gonopod. The middle-plate is rounded at its distal end (fig. 5 shows the profile and fig. 6 the anterior view); its anterior surface has a large number of small transverse striations, while its posterior part (" Telopodit " or " Hinterblatt " of Attems, 1926) consists externally of a long simple plate (shield-plate or " Schutzblatt " of Attems, 1926) and internally of a subrectangular

Fig. 8.



Ophyiulus pilosus (Newport), ♀. Terminal part of vulva of left side viewed from the posterior position. Slide 29. × 215.

O., operculum ; *V.*, valves of bursa ; *p.*, pigment-bands of valves ; *G.*, fovea coxalis ; *A.*, ampulla.

plate (groove-plate or "Rinnenblatt" of Attems, 1926). The groove-plate is rather complicated in structure and is produced anteriorly into a number of teeth. It has a groove (*G.*) which carries the flagellum.

FEMALE.

Vulvæ. (Figs. 8, 9, 10, 11, & 12.)

Each vulva is in the form of a complex subcylindrical chitinized projection ("mamelon" of Brölemann and Lichtenstein, March 1919). The bursa (cyphocoxite) (*B.*) has somewhat the appearance of a lamellibranch shell with the hinge of its valves turned posteriorly. It bears a number of long thin bristles. Each valve (*V.*) is strongly chitinized, and, in its posterior part, has a long band containing pigment (*p.*). Between the valves is a gutter (*G.*), the *fovea coxalis*, which is nearly closed in; from the gutter an almost straight tube communicates with the ampulla (*A.*). According to Brölemann and Lichtenstein

Fig. 9.

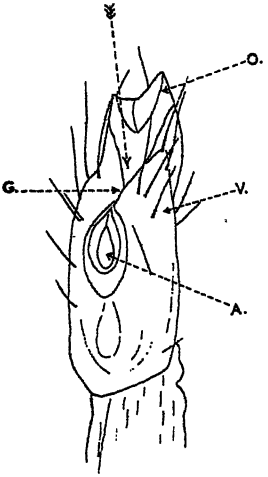
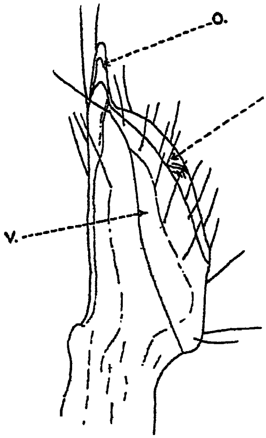


Fig. 10.



Ophyiulus pilosus (Newport), ♀.

Fig. 9.—Left posterior view of left vulva. Slide 50. × 70.
Fig. 10.—Left vulva, internal aspect. Slide 50. × 70.

Lettering as in fig. 8.

(March 1919) the ampulla contains glandular secretions, and is not, as some workers have supposed, for the reception of sperms. The operculum (*O.*) (cyphotelopodite) is a narrow plate, notched distally and attached basally to the bursa. The operculum is held between the valves

Fig. 11.

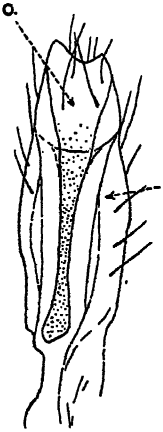
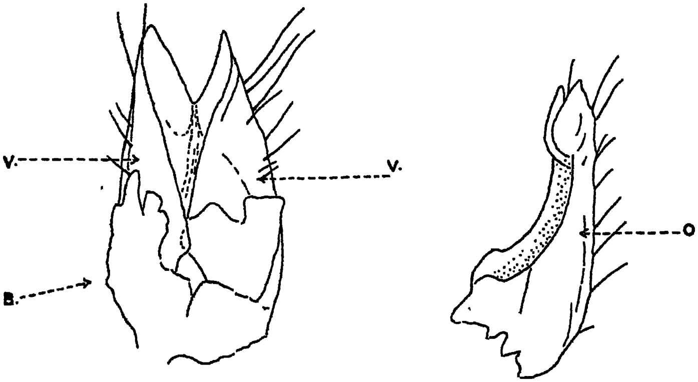


Fig. 12.



Ophyiulus pilosus (Newport), ♀.

Fig. 11.—Left vulva, anterior view. Slide 50. × 70.

Fig. 12.—Left vulva dissected to show the bursa (on the left) and operculum (on the right). Bursa viewed from anterior position; operculum, external aspect. Slide 48. × 70.

Lettering as in fig. 8.

of the bursa, which almost enclose it. The operculum is grooved on its posterior, *i.e.*, its inner face, and anteriorly bears a number of bristles. The opening of the oviduct lies between the operculum and the valves of the bursa in the position indicated by the arrow (*o.*). The distal part of the oviduct leading into the vulva is an almost straight tube.

The terminology of the vulvæ has been dealt with by Brölemann and Lichtenstein (March 1919); the present writer has drawn upon this for his own description.

HISTORICAL SURVEY.

This species was first described by Newport, 1842. The following is Newport's account (1843, p. 316):—

"Description of a new British *Iulus*. By George Newport, Esq. Iulus pilosus, Newp. *Very like* Iulus terrestris, *but smaller and more elegantly formed. Black, shining, segments fifty-six, deeply striated longitudinally, with the margin of each, more especially of all the posterior segments, set with fine white hairs; anal spine compressed and elongated.*

"The chief characteristics of this species are the fringe of delicate hairs at the posterior margin of the segments, and the number of the latter, which amounts to fifty-six; while in *Iulus terrestris*, with which this species may readily be confounded, there are never more than fifty-one, and usually but fifty. It occurs in the neighbourhood of London at the end of May, but is not common."

Newport was in error in fixing the number of segments at fifty-six. All specimens examined by the writer had less than this number.

The millepede described by C. L. Koch (1847, p. 113) as "J. Longabo" is apparently the same. Here is Koch's original description:—

"29. *J. Longabo.*

"Dünn, walzenförmig, ausserordentlich lang, mit 60 Körperringen; am Hinterrande des Seitenwinkels des Halsschildes sehr feine leicht zu übersehende Furchenstrichchen; die Körperringe tief gefurcht, die Furchen auf dem Rücken fast so breit als die Zwischenräume; das Schwänzchen gerade und spitz, dunkelbraun, der

Bauch und eine Fleckenreihe unten in den Seiten weiss. Länge 1″ 6‴.

" Vaterland. Süddeutschland."

The number of segments is again larger than that found by the writer. *J. fallax* Meinert (1868, p. 15) is certainly the same as *O. pilosus* :—

" 9. J. FALLAX.

" Subtenuis, ante sparsius, post densius crinitus.

" Vertex sulco vix ullo, foveis duabus setigeris in striam productis.

" Oculi subtriangulares, seriebus ocellorum octonis transversis (44).

" Antennæ altitudine corporis longiores (11 : 10).

" Segmentum primum lateribus leviter productis, post tenuiter striatis, ante aciculatis.

" Sculptura sat densa, profunda, striis marginem posticum segmentorum non attingentibus.

" Stigmata procul pone suturam transversam sita. Sutura fere recta.

" Valvulæ anales non marginatæ, hirsutæ.

" Pedes altitudine corporis multo breviores (2 : 3).

" Long. ♀ 22–27 m.m. ♂ 17–20 ; altit. ♀ 1,5–1,8 m.m. ♂ 0,9–1,0 m.m.

" Numerus segmentorum 48–55.

" Color nigro-fuscus, micans."

Latzel (1884, p. 313) described in detail *J. longabo* Koch and also (p. 316) what he thought to be *J. fallax* Meinert ; but, as Porat (1889, pp. 2, 43, & 65) pointed out, the latter animal is not *J. fallax* Meinert, but some other species, and *J. longabo* Koch and *J. fallax* Meinert are identical species. This is supported by the Brade-Birkses and Brölemann, who suggest the adoption of the name *Ophyiulus pilosus* (Newport). The generic name was given by Berlese (1882–1884).

The writer is indebted to the Rev. Dr. S. Graham Brade-Birks for help and advice.

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XVII.—*Parasitic Hymenoptera from Bear Island.* By A. ROMAN (Stockholm). With an Introduction by DAVID LACK (Cambridge).

INTRODUCTION.

The following material was collected when I was in Bear Island (in lat. 74° N.) in company with G. C. L. Bertram from June 20 to August 10, 1932. We published a general account of the Expedition in the 'Geographical Journal,' 1933, vol. lxxxi. pp. 45–53. My account of the Trichoptera, Lepidoptera, and Coleoptera obtained appeared in the 'Annals and Magazine of Natural History,' 1933, ser. 10, vol. xii. pp. 205–210. An account of the Crustacea by G. C. L. Bertram has also appeared in the same Journal, pp. 538–543, while W. S. Bristowe has published an account of the Spiders in 'Norsk Entomologisk Tidskrift,' iii. Heft 3, pp. 149–154.

This account, together with the following one on the Sawflies by Robert B. Benson, deals with all the Hymenoptera known from Bear Island.

Bear Island supports extremely few species of insects, but almost all those found, including the two species of parasitic Hymenoptera, were extremely numerous in individuals. It is therefore unlikely that the two other species of this group recorded by the Nathorst Expedition were overlooked in 1932, since the island is a small one. The summer came remarkably late in 1932 (see 'Geographical Journal'), and it is probable that the latter species emerged, if at all, after our departure. Some of the *Stenomacrus* collected by the Nathorst Expedition are dated July 7, but none appeared in 1932 until July 23, sixteen days later. The *Syndipnus* was first noted on July 17.

Both species of Ichneumonidæ appeared only on warm days, this especially applying to the *Stenomacrus*, which was numerous on only three of the nineteen days from July 23 to August 10, a very few isolated individuals appearing on three other days. Bear Island is almost perpetually fog-bound in summer, and warm and sunny days are rare. The average temperatures for the summer months are June 1·7° C., July 4·2° C., August 3·2° C., September 1·9° C. The Ichneumonidæ appeared to require a temperature of at least 6° C., perhaps more, before they emerged. The remaining time was apparently spent under the vegetation. On one occasion both species were seen emerging in swarms from a patch of *Salix polaris*, together with *Limnophora* sp. (Diptera, Anthomyidæ), which had a similar reaction to temperature. On warm days the *Stenomacrus* was found almost exclusively in the flower-heads of *Saxifraga cæspitosa*.

PARASITIC HYMENOPTERA FROM BEAR ISLAND.

The naked and mountainous Bear Island has too meagre a vegetation to possess a numerous Ichneumonid fauna, and till now only one species was known, the Cryptine *Microcryptus erraticus* Holmg. (*Phygadeuon*), existing as a single male in the Stockholm Museum. Now the Cambridge Expedition has brought home no less than 160 specimens of this family, quite an unexpected number. At a close inspection, however, they proved to belong to only two species, both of the subfamily Tryphoriinæ, but with quite different hosts. The one is a *Syndipnus*, and certainly parasitic on one of the three sawfly species met with on the Expedition; the other one, a *Stenomacrus*, probably infests some fungus gnat (Mycetophilidæ), for most of the older, highly varied rearing reports seem to be mistakes. This material is carefully mounted and labelled, but I am sorry to say that the specimens themselves are in bad condition, and no pleasure to study. Fortunately, in the Stockholm Museum was discovered a small lot of unnamed Bear Island Ichneumonids in very good condition, taken by the Swedish Nathorst Expedition in 1899, which was found to contain both the above-named Tryphonines, plus one male of the Cryptine *Aclastus gracilis* Thoms. (*Hemiteles*) var. *minutus* Bridg., and one female of the Braconid (Opiine) genus *Biosteres* Först. Consequently the complete list of parasitic Hymenoptera at present stands thus :—

ICHNEUMONIDÆ.

Microcryptus erraticus Holmg.
Aclastus gracilis minutus Bridg.
Stenomacrus pedestris Holmg.
Syndipnus beerensis, sp. n.

BRACONIDÆ.

Biosteres sp.

Stenomacrus pedestris Holmg. (*Orthocentrus*).

Nathorst Expedition, 1899 : July 7, 3 ♂ ; Aug. 14, 1 ♀.

Laksvatuet : July 23, 18 ♀, 13 ♂ ; July 24, 1 ♀, 1 ♂ ; Aug. 2, 7 ♀, 6 ♂. Kapp Oloff : July 28, 1 ♀ 1 ♂. Tunheim : Aug. 5, 25 ♀, 9 ♂.

This is the short-winged (♀) species of Spitzbergen, and seems to be quite common. The host may be some other gnat than a Mycetophilid, for the species reared from them have always belonged to the genus *Orthocentrus*, s. str., and I scarcely think a reliable rearing of a *Stenomacrus* has ever been published. This genus of pigmies being very common in all northern countries, it must have common hosts, and gnats of several groups fulfil this requirement in a high degree.

Syndipnus beerensis, sp. n.

Nathorst Expedition, 1899 : July 20 & Aug. 14, 2 ♀, 3 ♂ (types).

Royevatnet : July 17, 1 ♂. Laksvatuet : July 23, 4 ♂; July 24, 1 ♂ ; Aug. 2, 2 ♂. Ella Lake : July 26, 1 ♀, 8 ♂. Kapp Oloff : July 28, 3 ♀, 25 ♂. Kohlbukta: July 28, 1 ♂. Nordhamna : July 28, 2 ♀, 20 ♂. Hausvatnet : Aug. 4, 1 ♂. Tunheim : Aug. 5, 4 ♀, 5 ♂.

Sweden, Torne Lappmark, Vassijaure : July 16, 1918, 1 ♀ (*R. Malaise*, Coll. Roman).

♀. Nigra, clypeo, mandibularum basi (sæpe rufescente), puncto antealari, tegula, radice alari, limbo apicali segmentorum 4.–7. anguste, horum angulis apicalibus paullo latius, ventre toto maculis utrinque 4–5 nigris exceptis, calcaribusque omnibus stramineis vel albidis ; palpi obscuri. Obscure

rufa sunt: femora i.–ii., hæc sæpe basi infuscata, iii. saltim apice, tibiæ—iii. apice sensim infuscato tarsique i. basi, hi ceterum infuscati. Alæ hyalinæ nervis et stigmate fuscis, hoc basi latius testaceo.

Long. 4–5, ala antica vix 4·5 mm. (specimen suecanum 6·5 mm.; ala ant. 6 mm. longa).

Caput bene thoracis latitudine, pone oculos nonnihil angustatum sat rotundatum, antice visum vix longius quam latius, facie et fronte cum genis alutaceis, occipite temporibusque nitidis, clypeo polito antice late rotundato, in medio nonnihil inflexo, genis mandibularum basi æquilongis, his dentibus æqualibus, linea interocellari hac ocelloculari paullo longiore. Antennæ supra medium capitis a latere visi insertæ, filiformes corpore paullo breviores, dimidio apicali submoniliformi; scapo latitudine vix longiore, flagello (21) 22–23 (24)-articulato, in specimine suecano 26-articulato, postannello longitudine scapi+pedicelli, quam articulo 2. vix 1·5×longiore, articulis omnibus elongatis, ultimo rarius penultimo longiore (rarissime obsolete diviso). *Thorax* subcompressus altitudine dimidio longior, pronoti lateribus opacis subrugosis, mesothorace præsertim dorso nitido, inter notaulos medium attingentes postice opaciore, scutello lateribus opacis, pleuris ±nitidis subtiliter sculpturatis, speculo parvo polito, pectore subquadrato mesolco sat profundo postice aperto. Segm. medianum a latere visum mesothorace abrupte minus, totum cum metapleuris rugosum, area postica minus distincta rotundata medium vix attingente, costa pleurali distincta, laterali sat obsoleta. *Abdomen* modice depressum apice leviter compressum, thorace nonnihil angustius, capite+thorace sublongius, segm. 1. 2° longius basi angustum alutaceum, spiraculis ante medium sitis dentatim prominentibus, postpetiolo apicem versus dilatato latitudine apicali sublongiore, sulco dorsali angusto spiracula superante at carinis nullis marginato, segmento 2. subtransverso apicem versus normaliter parum dilatato, alutaceo, spiraculis prope basin sitis, variolis rotundatis nitidis, segmento 3. 2° parum breviore cum ceteris nitidulo, ultimis duobus brevissimis, ventre lateribus corneo-maculato, hypopygio subcompresso apice truncato apicem abdominis attingente, terebra valvulis tenuibus brevissime exsertis. *Pedes* graciles, iii. anterioribus modice longiores femoribus latitudine 5–6×longioribus, tibiis rectis breviter albo-pubescentibus, tarsis tenuibus tibia paullo longioribus, metatarso articulis 2.+3. sublongiore, ungue articulo 3., i.–ii. sublongiore, iii. paulo breviore, articulo 4., latitudine sua, i.–ii. parum, iii. duplo longiore, unguiculis parvis pulvillum non superantibus. *Alæ* amplæ abdomen vix superantes, stigmate radium fere ante medium

emittente, nervo basali subrecto fere verticale; posticæ abscissa radii nervo recurrente plus duplo longiore, nervello antefurcali inferne fracto, hamulis 6.

♂ præter apparatum sexualem differt: facie plerumque supra clypeum punctis duobus geminis stramineis (in duobus individuis e Nordhamna die 28/7 oriundis cum orbitis concoloribus facialibus coalitis et in genas continuatis, scapi puncto subtus, lineola ante alas, coxis i.–ii. proparte, trochanteribusque omnibus latius) ornatis, pedibus latius nigricantibus, flagello antennali rarissime 24-articulato.

Long. ad 6 mm.

This is a transition species to the Försterian genus *Synodites* by its rather long genæ, but in everything else it is a typical *Syndipnus*. In the key of Schmiedeknecht one arrives at *Synod. contractus* Thoms. (not identical with *Mesoleius contractus* Holmg., which, according to the type, is a genuine *Mesoleius*), and, in fact, it much resembles Thomson's species. This has, however, paler legs, the first flagellar joint very little longer than the second, the propodeum with a distinct area centralis, and the second abdominal tergite shining with rather obsolete "variolæ." It was interesting to find a specimen of this arctic species among my unnamed Lapland Tryphonids. It was secured just above timber-line, where no taller vegetation grows than 3–4 feet high willow-bushes, and where many other exclusively alpine Ichneumonids have been found. Nevertheless, the size of this specimen shows that its life conditions were far better than on Bear Island. It is remarkable the Cambridge Expedition found such an abundance of this new species, for I can only remember one occasion when I got quite a lot of *S. lateralis* Gr. from a friend, who had taken them on a damp meadow in the environs of Stockholm. Generally this genus occurs singly or in few specimens in a day's bag, but in the north it is more numerous.

XVIII.—*Sawflies from Bear Island* (*Hymenoptera, Symphyta*). By Robert B. Benson, M.A., British Museum (Nat. Hist.).

Introduction.

This account of the sawflies of Bear Island deals with the collection made by G. C. L. Bertram and D. Lack in 1932, and forms part of a series of papers published on the results of this expedition, for particulars of which see the Introduction to the article on the "Parasitic Hymenoptera from Bear Island" that precedes this.

All the species represented in the collection had been previously obtained on the island by Mr. Elton in 1921; Morice (1922), in writing about Mr. Elton's collection, details all the references known to him of the occurrences of sawflies in Bear Island and Spitzbergen, together with their synonomy. It was not thought necessary to repeat these references, but only to add to them. Three species only are recorded from Bear Island, and so far only two of these from Spitzbergen; *Amauronematus alberich*, sp. n., has only been found on Bear Island; *Amauronematus villosus* Thom. occurs also in Spitzbergen, Lappland, and Jemtland (Sweden); *Pristiphora frigida* Bohem., in Spitzbergen as well as Bear Island.

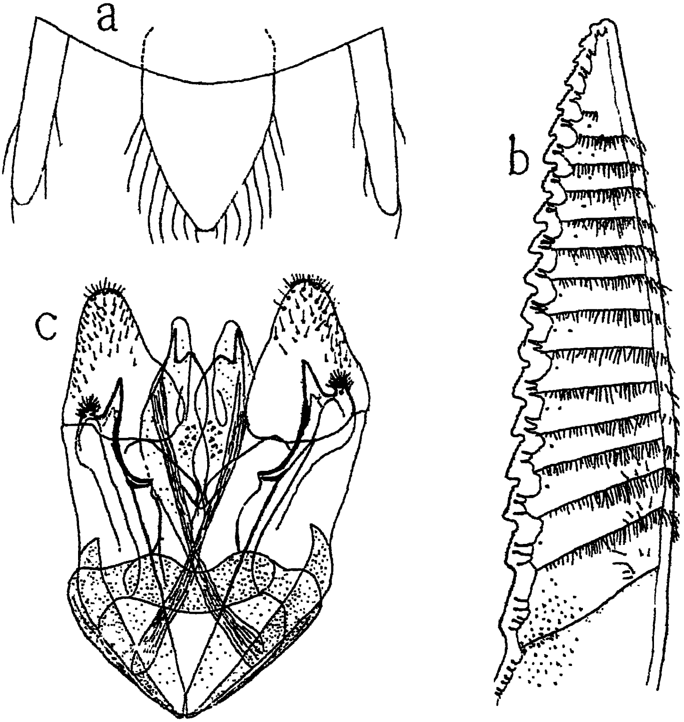
Nothing is yet known for certain about the biology of any of these species, although it is probable that one or more of them are attached to the *Salix polaris* Marsh which is found on the island.

One larva was found by Lack feeding on this *Salix*, and though the larva spun up it died without pupating. No record was kept of the colour or form of the larva, and it is in too bad a condition to tell anything now. It appears to be Nematine and is probably the larva of one of these three species.

Amauronematus alberich, sp. n.

Pontania birulæ Kon., Morice, 1922, p. 220.
? *Euura* sp., Thor. 1930, p. 54.

♀.—*Colour* yellowish brown, suffused with black as follows:—*Head*: in the holotype with the frontal area, the face round the antennæ, and the upper side of the antennæ, in the paratype the whole head except the labrum, clypeus, supra-clypeal area, a mark on the temples, and the underside of the antenna black. *Thorax* in the holotype with a black central mark on each of the three mesonotal lobes, the hinder part of the scutellum, the whole of the metanotum, and all the under thorax except for an area in the middle of the mesopleura; in the paratype all black except for the hind margin of the pronotum, the tegula, and a pale area in the middle of the mesopleura. *Legs* with the coxæ (except the hind one distally), the front and middle trochanters, the proximal half of the femora, the tarsal segments distally black. *Wings* hyaline; costa and stigma yellowish white; other veins brown. *Abdomen* black except for the sides of terga 7, 8, and the whole of the apical segments; saw-sheath black at the apex, but brownish in the neighbourhood of the hypopygium.



Amauronematus alberich, sp. n.

a. Female saw-sheath viewed from above.
b. Female saw.
c. Male genitalia.

♀.—*Structure*:—*Head* not contracted behind the eyes; surface puncturation slight on temples and obsolete in frontal area; labrum obtuse; clypeus short and broadly emarginate in front; malar space variable, in the holotype shorter than antennal segments, in the paratype longer; supra-antennal groove triangular in outline, clearly defined, and cut off from the frontal area, which is clearly margined with a small carina; post-ocellar area defined clearly at the sides and behind, but not in front; antennæ short, thread-like, segments 3 to 5 equal in length. *Thorax* smooth and shining, with vague surface puncturation limited to the upper side and with scattered short pubescence. *Abdomen* short and broad; saw-sheath (fig. *a*); saw (fig. *b*).

Length 4–5 mm.; wing 4·5 mm.; antenna 2·5 mm.

♂.—*Colour* all black except for the tibiæ and tarsi (which are mostly brown, sometimes obscured with very dark brown, almost black), and the pale apical segments beyond the ninth, with the genital organs; *wings* as in ♀, though in some specimens the stigma is tinged with brown.

♂.—*Structure* as in ♀, except that in some specimens the supra-antennal groove and frontal area are less clearly defined, the antennæ are longer, segment 4 being a little longer than 5 and considerably longer than 3, and also except for the genital segments. Prolongation to the hind end of tergum 8 does not reach so much as its own breadth beyond the end of the segment, but the front of the prolongation is continued forward, separated on each side by a deep furrow, near to the front margin of segment 7. Genitalia (fig. *c*).

Length 4–5 mm.; wing 4–5 mm.; antenna 3–5 mm.

Types: Bear Island, Nordhama, 1 ♀, 28. vii. 1932 (*holotype*), 1 ♂, 23. vi. 1932 (*allotype*); Röyevatnet, 6 ♂, 1 ♀, 17. vii. 1932; Syvertsentjorna, 1 ♂, 12. vii. 1932; Laksvatnet, 1 ♂, 23. vii. 1932; Ella Lake, 1 ♂, 26. vii. 1932.

Morice (1922) said that he did not feel much hesitation in identifying this species with *Pontania birulæ* Kon., 1907, although he confesses he had never seen the author's types and although he had only males to examine, and the males do not exhibit the best specific characters, and although the New Siberian Islands, from which *P. birulæ* Kon. was described, are situated very far away across the Arctic Ocean from Bear Island. It appears to me that the two are certainly different species; Konow says of *P. birulæ* Kon., "area frontali deleta, subtus non marginata." In the specimens under consideration the frontal area is sharply margined with a distinct keel;

this applies to the specimens collected by Elton as well as to Lack's specimens. The character of the frontal area is generally fairly stable in this genus and is not given much to individual variation. It is clear therefore that they cannot belong to *P. birulæ* Kon., and it is difficult to understand why Morice identified them with that species at all.

The new species is very close in structure to *Pontania forsiusi* Enslin and *P. phylicifoliæ* Forsius, from which species it differs in the keeled frontal area and the broader saw-sheath when viewed from above. It also differs from *P. phylicifoliæ* Forsius in that the clypeus is only roundly emarginate in front and not sharply excised, the cerci are long, being almost as long as the saw-sheath, while in *P. phylicifoliæ* Forsius they are considerably shorter than the saw-sheath.

In spite of this close similarity with species of the genus *Pontania* it was decided to place the new species in *Amauronematus.* In adult structure the genera run very close, but the saw of the new species is more typical of *Amauronematus* and is better placed there unless the larvæ are found to be the inhabitants of galls. *Pontania forsiusi* Enslin would also be better placed in *Amauronematus.*

The specimen recorded by Sig. Thor (1930) as "*Euura* ? sp." may, of course, be some entirely different species not represented in the present collection; but as *Euura* adults are separated from those of *Pontania* mostly on a small neuration character—the absence of the second transverse cubital cross-vein—it is very probable that this is a slightly abnormal specimen belonging to the same species. Such specimens are quite common in any moderately long series of *Pontania* or other Nematinæ.

Amauronematus villosus Thoms.

Amauronematus hyperboreus Thoms., Koenige & Le Roi, 1911, p. 275.
Amauronematus villosus Thoms., Morice, 1922, p. 220 (for further bibliography).

Bear Island, Bollevatnet, 1 ♀, 4. vii. 1932; Laksvatnet, 1 ♀, 10. vii. 1932; Röyevatnet, 3 ♂♂, 17. vii. 1932; Walrus Bay, 1 ♀, 18. vii. 1932; Antarctic Fjellet, 1 ♀, 18. vii. 1932; north foot of Mount Misery, 2 ♀, 18. vii. 1932, 1 ♀, 20. vii. 1932, 1 ♀, 29. vii. 1932.

All these specimens have segment 3 of the antennæ decidedly shorter than segment 4. In the females the average proportion is 8 : 9, in the males 4 : 5. This same proportion applies also to the specimens of this species taken by Elton in Bear Island in 1921 ; the type-specimen of *Nematus brachyacanthus* var. *palliditarsis* Cameron (Spitzbergen), which was also described as *Nematus gelidus* W. F. Kirby, belongs to the same species, but now, unfortunately, has its antennæ missing.

In Enslin's key, 1915, p. 403, this species is placed in the group with antennal segment 3 longer than 4, and although this character is used for a major division of the genus, yet Enslin notes that sometimes in this particular species segment 3 is shorter than segment 4.

Amauronematus villosus Thoms. is not a typical representative of the genus. It would be better to restrict the genus to those species with short antennæ in the female. The species with long antennæ are at present placed in *Nematus* (=*Holcocneme*) ; this is but an arbitrary arrangement, as the genus now contains species which are clearly not related closely to each other—*N. lucidus* Panz., the genotype, for instance, is more closely related to *Amauronematus histrio* Lep. than to *N. crassus* Fall. Rather than add to this confusion it has been decided to retain *A. villosus* Thoms. for the present in the genus *Amauronematus*, where it was placed by Konow.

Pristiphora frigida Bohem.

Pristiphora adelungi Knw., Koenige & Le Roi, 1911, p. 275.
Pristiphora frigida Bohem., Morice, 1922, p. 220 (for further bibliography).

Bear Island, Walrus Bay, 11 ♂, 5 ♀, 29. vi. 1932.

P. frigida Bohem. is not a normal representative of the genus *Pristiphora*, but it belongs to the group with bifid claws, which, together with the type of saw, suggest a link with the genus *Pontopristia*. The European *Pristiphora amentorun* Först., of which the type-series was bred out of *Salix* catkins *, and the North American *Pontania amentivora* Rohw., which was bred from larvæ feeding in the pistillate catkins of *Salix humilis* Wahlemb., both appear also to belong to this group of species; but it is not yet known whether the larvæ of other members of this species group also live in *Salix* catkins.

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* The fact that *Pristiphora amentorum* Först. was bred from *Salix* catkins has been overlooked by recent authors, although it was recorded in the original description of this species (Förster, Ver. Naturhist. Ver. d. preuss. Rheinl. xi. 1854, p. 334).

The eighth tergum in the male of *Pristiphora frigida* Bohem. has the typical depressed triangle and raised longitudinal keel not projecting distally of normal *Pristiphora*; the details of this tergum in *Pontopristia* and other members of the group are not described.

? Genus Nematine larva.

Bear Island, near Tunheim, 1 larva feeding on *Salix polaris* Marsh, 4. viii. 1932. This larvæ spun a cocoon on the way home to England, but dried up without pupating. It probably belonged to one of the species mentioned above.

References.

Enslin. (1912–1917.) 'Die Tenthredinoidea Mitteleuropas,' pp. 374 & 402–403.

Koenige & Le Roi. (1911.) 'Avifauna Spitzbergensis: Hymenoptera,' pp. 275–276.

Morice. (1922.) "Results of the Oxford University Expedition to Spitzbergen, 1921.—No. 15. Sawflies." Ann. & Mag. Nat. Hist. (9) vol. x. pp. 219–220.

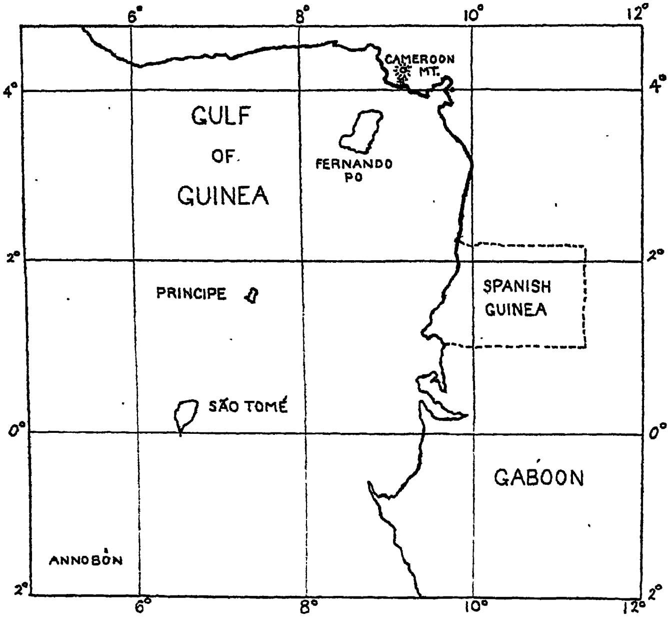
Thor. (1930.) "Beiträge der Kenntnis der Invertebraten Fauna von Svalbard." Skrifter om Svalbard og Ishavet, nr. 27, p. 54.

XIX.—*The Percy Sladen and Godman Trusts Expedition to the Islands in the Gulf of Guinea, October* 1932–*March* 1933.—I. *Introduction.* By W. H. T. Tams, of the British Museum (Nat. Hist.).

In 1932 the Trustees of the British Museum granted five months' special leave to Mr. A. W. Exell and myself in order that we might investigate the fauna and flora of the islands in the Gulf of Guinea. The expedition was rendered possible by generous grants from the Percy Sladen Memorial Fund and the Godman Exploration Fund, and we left at the beginning of October for São Tomé. On the way we paid a visit to the Natural History institutions connected with the University of Coimbra in Portugal, where we received many valuable suggestions and introductions which contributed greatly to the success of the expedition.

A general illustrated account of the expedition has appeared in the 'Natural History Magazine,' vol. iv. nos. 28, 29, 30 (October 1923, January and April 1934), and it is therefore only necessary for the purposes of this introduction to give some idea of the parts of the islands visited, with sketch-maps showing the localities in which collections were made. (Map 1.)

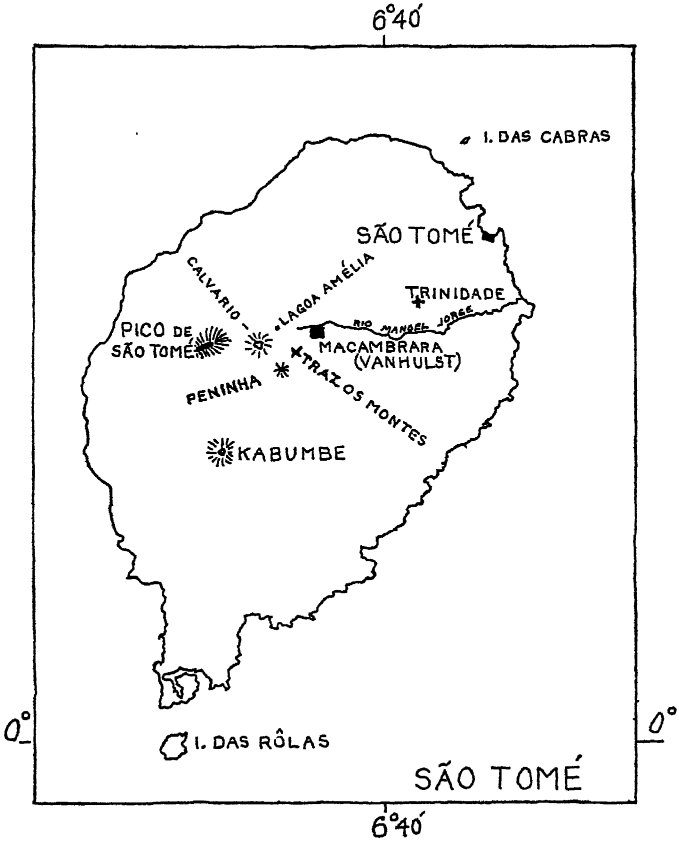
Map 1.



São Tomé.

We arrived at São Tomé on October 20, 1932, and on the following day went to the Cable Station, where the Superintendent, Mr. L. P. Cauvin, very kindly took us in and gave us every assistance. It is difficult to express adequately the gratitude we owe this gentleman, to whom the greater part of the success of our sojourn in São Tome and Principe is due. Through his efforts we were offered the use of the little house at Macambrará (Vanhulst) by Mr. W. G. Van Leeuwen, Vice-Consul for the Netherlands. We lived at Vanhulst from October 27 to November 26, and during that time paid three visits to Lagoa Amélia and one to the Pico de São Tomé. From an entomological point of view São Tomé at this, the wet

Map 2.

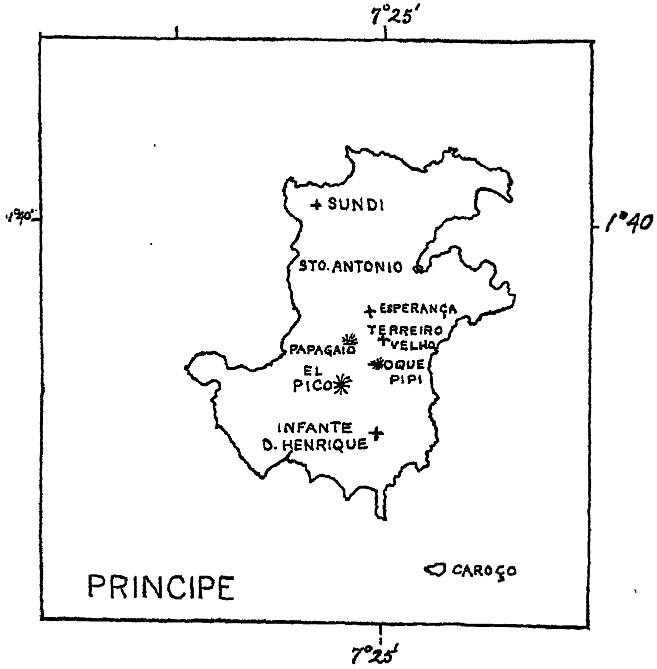


season, was not very productive, and the four excursions were only successful botanically. The insects collected in São Tomé did not total a large number, but many interesting species were taken, including a fair proportion of new species. (Map 2.)

PRINCIPE.

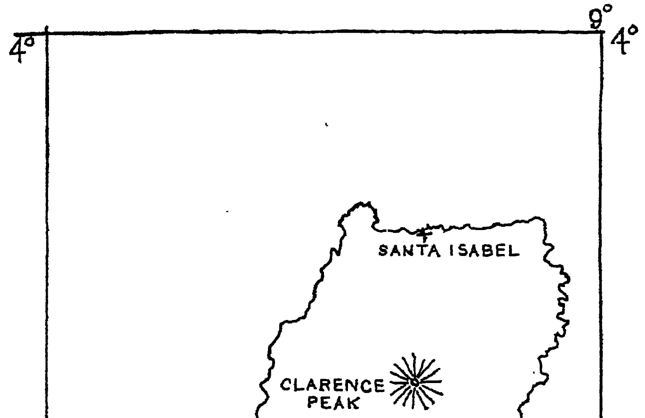
We reached Principe on December 5, 1932, and remained there till January 4, 1933. We stayed at three Roças in Principe, viz. Terreiro Velho, Infante Dom Henrique, and Esperança. Butterflies were commoner here than in São Tomé, but again hard work did not produce other insects in very large numbers, though botanical collecting was on the whole quite profitable.

Map 3.



Working at light at the house at Terreiro Velho was most disappointing, and no better success was met with at the camp I set up on Oque Pipi. Having discovered that the Roça Infanta Dom Henrique in the south-east corner of the island occupied a somewhat sheltered situation with some forest-clad slopes to the north, we made friends with the Administrador, who spoke perfect English and took great interest in what we were doing, and he very kindly invited us to stay a few days there. This was the only place in the island where moths came freely to light. We reluctantly said farewell to our host on December 23, and moved to the Roça Esperança, where we remained until January 4, 1933, on which date we sailed for São Tomé. During our stay at the Roça Esperança we climbed the Pico Papagaio, which was extremely interesting botanically, but provided little in the way of insects other than butterflies. (Map 3.)

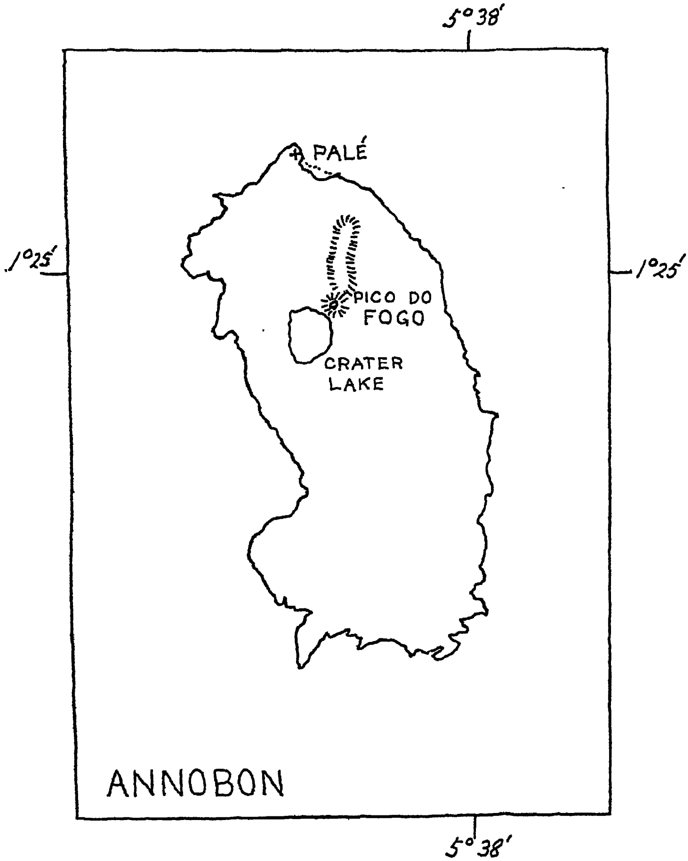
Map 4.



FERNANDO PO.

We did not arrive in Santa Isabel, Fernando Po, until January 26, having travelled by way of Libreville, Gaboon, where we did not land, and Duala, Fr. Cameroons, where we were stranded for a fortnight. We were fortunate in being able to leave on January 27 for Concepcion and Moka, where we spent six days in a wonderful tract of mountain prairie, where grew a giant species of each of the genera *Lobelia*, *Senecio*, and *Hyperi-*

Map 5.



cum. Here insects were plentiful, and moths came freely to light, in spite of the low temperature at night.

We returned to Santa Isabel to catch the boat leaving on February 8 for Annobon. (Map 4.)

ANNOBON.

We reached this beautiful little island on the morning of February 15, and made the most of two short days here. Insects were not plentiful; probably the most interesting, in view of its isolation, was the water-skater found on the Crater Lake, to which I was able to make two trips. (Map 5.)

This short account will serve as a check on the data connected with the specimens. The sketch-maps practically contain only those localities actually visited. The mountain Kabumbe in São Tomé we were unable to visit, and we did not succeed in reaching El Pico in Principe. We visited Moka Lake, but had no time to explore the Cordilleras to the south.

The following is a summary of dates :—

São Tomé (20. x. 1932–4. xii. 1932 ; 5–11. i. 1933).
  Dependencia Macambrará (Vanhulst) : 27. x. 1932–26. xi. 1932.
  Lagoa Amélia : 3, 5, 18. xi. 1932.
  Calvario : 11. xi. 1932.
  Pico de São Tomé : 12. xi. 1932.

Principe (5. xii. 1932–4. i. 1933).
  Dependencia Terreiro Velho : 5. xii. 1932–16. xii. 1932.
  Oque Pipi : 7, 10, 11. xii. 1932.
  Roça Sundi : 17. xii. 1932.
  Infante Dom Henrique : 18–23. xii. 1932.
  Roça Esperança : 24. xii. 1932–4. i. 1933.
  Pico Papagaio : 29. xii. 1932.

Fernando Po : (26. i. 1933–7. ii. 1933).
  Moka : 28. i.–3. ii. 1933.
  Moka Lake : 30. i. 1933.
  Mioko mineral spring : 1. ii. 1933.

Annobon : 15, 16. ii. 1933.

XX.—*Some new or little-known South African Bees of the Genus* Allodape *in the British Museum.* By T. D. A. COCKERELL.

IT appears to be impossible to collect bees for a few hours in any part of the Ethiopian Region without taking one or more species of *Allodape*. Lepeletier and Serville proposed the generic name for a species (*A. rufogastra*) from Caffraria, and it was supposed that it was parasitic on some other genus of bees. Dr. H. Brauns (Ann. S. African Museum, xxiii. 1926) described the habits in detail, the large eggs, and the peculiar larvæ. The larvæ are fed by the mother bee. Brauns figures two very different types of larvæ, and explains how their characters are adapted to their habits and the mode of feeding by the mother. He also refers to a third type represented by " a small species making its nest in the Karroo plains in the dry stems of a native asparagus." Unfortunately this species is neither named nor described.

The first type of larva described by Brauns is that of *A. ceratinoides* Gribodo (*crinita* Brauns), which we now refer to *A. panurgoides* Smith. It belongs to a group with three longitudinal stripes on the face of the female and the hind trochanters of the male strongly dentate. This is typical *Allodape*. The second type of larva, having a number of fleshy contractile appendages on the segments, is typified by what Brauns calls *A. pringlei* Cam. (*pungens* Brauns). The females of this group have a different face-pattern, usually with a T-like mark, or a broad band, or a more or less hourglass-like mark, on the clypeus, while the hind trochanters are simple in the males. This is the group of *A. variegata* Smith, which certainly deserves to rank as a subgenus, and perhaps as a genus. I propose for it the name *Allodapula*, type *variegata*. To this group belong the Asiatic and Australian species, as well as very numerous species of Africa. Another distinct group, not discussed by Brauns, is that of *A. candida* Smith, common in East Africa. For this I have already (1930) proposed the generic name *Macrogalea*. There is a species of this group in Madagascar.

Although *Allodape* is not parasitic on any bee, there is a very singular bee, *Eucondylops konowi* Brauns, which is a parasite or inquiline in *Allodape* nests. I saw this insect in the Transvaal Museum, and noted: about 6 mm. long, slender, black, shining, with dusky red legs; abdomen shaped much as in *Ceratina*; flagellum very thick; mesothorax polished; wings brownish; stigma large, dusky rufous; marginal cell long, rather narrowly rounded at end; basal nervure falling short of nervulus; two cubital cells, the second small and subtriangular, receiving the only recurrent nervure toward base. An insect of peculiar build, practically without hair; base of metathorax with a median pit or basin; on each side of supraclypeal area is a broad shining sulcus. Friese places this in a special subfamily, Eucondylopinæ, presumably derived from Ceratinid stock. The single recurrent nervure suggests affinity with *Exoneura*, a genus abundant in Australia and apparently derived directly from *Allodape*. There is also a closely related genus *Exoneuridia*, containing *E. libanensis* Friese, from Syria. It is probable that the loss of a recurrent nervure may have occurred independently in each of these genera.

I am very much indebted to the Trustees of the British Museum for lending me most of the material on which this paper is based.

GROUP OF *ALLODAPE PANURGOIDES* SMITH.

Large or rather large species, with black scutellum; abdomen black; face of female usually trilineate; hind trochanters of male dentate. *A. bimaculata* is exceptional in having two little pale spots on scutellum, and several species have the clypeus all black.

Allodape panurgoides Smith.

The type female (Brit. Mus.) is distinguished from the type of *A. pictifrons* Smith by being larger, sides of thorax with red hair, second cubital cell longer, hind tibiæ and tarsi with bright red hair. *A. ceratinoides* Gribodo and *A. crinita* Brauns are evidently the same. The female clypeus is rough and coarsely punctured, with a fovea at each side.

Cape Province: Mossel Bay, female (*Turner*); Albertinia, female (*Turner*); Montagu Pass (*A. Mackie, L. Ogilvie*).

A male from Milnerton (*Turner*) differs by the darker stigma; one from Camps Bay (*Turner*) differs by the white pubescence. Characteristic females are from George (*Turner*) and Doorn River (*A. M.*).

Allodape triodontopus Cockerell.

The male is larger and more robust than *A. strigata* Brauns, and the face-marks are yellow (cream-colour in *strigata*). The pattern of the face, with the broad lower part of lateral marks contiguous with clypeus far above clypeal constriction, at once distinguishes the male from *A. panurgoides*.

I have before me five males from Huguenot (*A. M.*, *J. O.*, *L. O.*), one from Paarl Mountain (*J. O.*), and one from Ceres (*Turner*).

The females have dull white hair at sides of thorax, never red as in *A. panurgoides*. A long series of females can be divided as follows:—

Patch on hind tibiæ red. [One from Paarl (*J. B. Le Roux*); two Paarl Mountain (*J. O.*); five Huguenot (*J. O.*, *L. O.*); eight Ceres (*Turner*, *J. O.*). Small females from Camps Bay (*Turner*) and Lion Head, Cape Town (*Turner*) are referred here with some doubt. The Camps Bay one has the clypeus very flat.]

Patch on hind tibiæ black .... 1.

1. Larger; tegulæ more or less testaceous, with a cream-coloured spot. [One Paarl Mtn. (*J. O.*); two Huguenot (*A. M.*, *J. O.*); eight Ceres (*Turner*); one Willowmore (*Turner*).]

Averaging rather smaller, but size variable; tegulæ dark brown. [Two Ceres (*Turner*), three Huguenot (*J. O.*, *A. M.*).]

It will be seen that these forms occupy exactly the same territory, but there is a related species, *A. strigata* Brauns, of which I have three males from Ceres (*Turner*). I observe in male *strigata* a distinct red tibial patch, though this is not always very evident; the tegulæ vary from uniform brown to the lighter, spotted type. In male *A. triodontopus* the tibial patch, when well developed, is chocolate-colour. It accordingly seems probable that of the three forms of females recorded above the first is *A. strigata* and the second and third are *A. triodontopus*. I have so labelled them, but am prepared to be corrected by observers in the field. *A. strigata* is supposed to be the same as *A. pictifrons* Sm., but Smith's species is said to be from Sierra Leone. The type-locality of *A. strigata* is Willowmore. A male *A. strigata* from Camps Bay, Cape Peninsula (*Turner*), is easily distinguished from

A. triodontopus by the creamy-white face and parallel sides of upper part of clypeus; but the hair-patch on hind tibiæ is chocolate-colour rather than red.

A female from Weenen, Natal (*Thomasset*), entirely too large and robust for *A. stellarum*, with red tibial patch, the second cubital cell broad above, the wings hyaline, faintly greyish, is referred to *A. strigata*, variety, but may be a distinct species.

Allodape stellarum Cockerell.

Natal: females from Durban (*J. O.*); the Bluff, Durban (*Ckll.*); south of Durban (*Ckll.*); Ingogo (*A. M.*); Amanzimtoti (*J. O.*). Also from Eshowe, Zululand (*Turner*).

A male from Port St. John, Pondoland (*Turner*), with greyish-hyaline wings, appeared to differ from a Natal male in having second recurrent nervure much nearer apex of second cubital cell than first to base, the reverse being true in the Natal male. But the female type of *A. stellarum* has the first recurrent more distant from base than second from apex. Thus these venational differences are evidently not of specific value. Females from Port St. John have the tibial patch black, but seem to belong to the same species. Three females from Louis Trichardt, Transvaal (*A. M.*, *L. O.*), have brownish wings and slender stripes on face. The second cubital cell is contracted above as in the type of *A. stellarum*. Two females from Vumba, Umtali, S. Rhodesia (*A. M.*, *J. O.*), with brown wings, have the second cubital cell very broad above, and are referred to *A. microsticta* as a variety. These Transvaal and Vumba females all have the hind tibial patch black, not light red as in type *stellarum*. I find that a small female from Paarl Mountain, which I had assumed to be an individual variation of *A. triodontopus*, has the second cubital cell narrowed practically as in *stellarum*. It may be supposed that there are some additional closely related species, which will only be satisfactorily separated when field observations have been made and the males are known.

Allodape stellarum rhodoptera, subsp. n.

♀.—Wings deep red (anterior wing 6·4 mm. long), second cubital cell moderately narrowed above; hind tibial patch very small, but red; facial stripes cream-colour, distinct, the lateral ones at least twice as broad below as above.

Natal: Van Reenen, Drakensberg, Dec. 1926 (*Turner*), British Museum.

Male *A. stellarum* from Port St. John, Pondoland, has the wings varying from greyish hyaline to brownish.

Allodape nigrilabris, sp. n.

♂.—Length about 7·5 mm., anterior wing 6.

Black, similar to *A. panurgoides* but less robust; face-markings bright chrome-yellow; hair of head and thorax pale, reddish dorsally, greyish white at sides of thorax; tegulæ dark brown. Wings reddish hyaline, stigma pale dull reddish; basal nervure nearly meeting nervulus; second cubital cell receiving recurrent nervures almost equally distant from base and apex. Scutellum shining, ordinary; fringe of long hair at apex of abdomen light red. Known especially by the entirely black labrum. The clypeus is all yellow (orange), subtruncate, but somewhat rounded above, with a pair of minute black dots; at the sides the clypeal yellow is moderately constricted, and the lateral marks (formed as in allied species) come off just below the constriction, but are separated from the clypeus for some distance by no more than a black line. Compared with *A. panurgoides* the lower end of the lateral marks is closer to the clypeus, so that if the black line is ignored the lateral marks can be said to leave the clypeus above the constriction, a description which could not at all apply to *A. panurgoides*. Compared with *A. triodontopus* the whole effect is very different, the lateral marks of that species being actually contiguous with the clypeal yellow to considerably above the constriction. Hind tibial tuft red.

Cape Province: Ceres, 1,500 feet., Jan. 1–3, 1921 (*Turner*). British Museum.

Allodape tristis, sp. n.

♀ (type).—Length about 9 mm., anterior wing 6·5.

Black, similar to *A. pangurgoides*, lateral marks reduced to slender lines along orbits, failing below; clypeus black, yellow stripe along posterior orbits distinct; flagellum with apical part reddish beneath; hair of head and thorax scanty, greyish white; scutellum rather closely punctured, not foveate; tegulæ very dark bown. Wings strongly reddened; stigma slender, brown; basal nervure practically meeting nervulus; second cubital cell very long, receiving first recurrent nervure far from base, the second much nearer (though not very near) apex. Hair on hind tibiæ and tarsi silvery white, the tibial tuft black; third to fifth tergites very rugose.

♂.—Yellow area of clypeus cone-shaped, the base on lower margin; in one specimen the upper end of the cone emits a little hook-shaped extension on each side; lateral marks as in related species, leaving clypeus at about level of constriction; labrum black; yellow line along posterior orbits very distinct; long hair at apex of abdomen red; hind tibiæ with a red tuft; hind trochanters dentate. This male is referred here with some doubt; it is also possible that it represents a more melanic form of *A. nigrilabris*, described above.

Cape Province: Cere, eleven collected by Turner (Brit. Mus.). Three from Huguenot (*A. M.*, *J. O.*). These are females; there are three males from Ceres (*Turner*, *J. Ogilvie*).

There are two other females with black clypeus, superficially similar to *A. tristis*; the three may be readily separated by the character of the face, as follows:—

Clypeus long and narrow, rough and densely, quite coarsely, punctured; at each side of it a subtriangular smooth area, with a few very large punctures	*tristis.*
Clypeus broad and flat, shining, with numerous weak punctures; lateral areas with large punctures	*explanata.*
Clypeus narrow, dull, very finely punctured, with a slight median ridge; lateral areas with minute punctures..	*microsticta.*

Allodape explanata, sp. n.

♀.—Length about 9 mm., anterior wing 8.

Black, similar to *A. panurgoides*, but clypeus all black, lateral marks narrow bands along orbits, cream-coloured, sometimes perceptibly enlarged below; stripes behind posterior orbits well developed; antennæ entirely black; mesothorax highly polished, scutellum with minute punctures; tegulæ small and dark, pallid in front. Wings dilute reddish brown, stigma dusky brown; basal nervure nearly meeting nervulus; second cubital cell very large, receiving first recurrent nervure far from base, the second nearer apex. Hind tibiæ and tarsi with silvery hair, the tibial tuft black; abdomen broad.

Cape Province: Mossel Bay (type-locality), Jan. 1922 (*Turner*); two from Montagu, Oct. 1924 (*Turner*). British Museum.

Smaller than *A. friesei* Brauns, with flatter, more weakly punctured clypeus. Distinguished from *A. planiceps* Strand by the dark wings and lateral face-marks along orbits.

Allodape microsticta, sp. n.

♀.—Length about 7·5 mm., anterior wing 6.

Black, similar to *A. panurgoides*, but clypeus black; lateral face-marks yellow, a little broadened below, above reduced to the finest possible line; marks along posterior orbits slender; antennæ black; mesothorax polished; scutellum dullish, with excessively fine punctures; hair of head and thorax scanty, short and white; tegulæ black. Wings dilute brownish, stigma black, nervures dark; basal nervure nearly meeting nervulus; second cubital cell rather short, receiving first recurrent nervure far from base, second very near apex. Hind tibial tuft black.

A variety has a clypeal stripe.

S. Rhodesia: three from Vumba, Umtali, May 23–26, 1932 (*J. Ogilvie*), also two with stripe on clypeus (*A. M.*, *J. O.*).

Allodape grandis, sp. n.

♀ (type).—Length 11–12 mm., anterior wing nearly 9.

Black, similar to *A. friesei* Brauns, with clypeus all black, but head much larger, eyes light brown (black in *friesei*). Clypeus broadly flattened; yellow lateral marks long cuneate, the abrupt broadened base a little above level of clypeal constriction, the upper end evanescent; posterior orbital stripes slender; antennæ black; hair of sides of thorax white; mesothorax highly polished on disk, scutellum dullish from numerous punctures; tegulæ entirely very dark brown (largely hyaline in *friesei*). Wings very strongly reddish brown, stigma very dark reddish; basal nervure almost meeting nervulus; second cubital cell extremely long, receiving first recurrent nervure very far from base, the second about half as far from apex. Middle and hind tarsi with bright red hair on inner side; hind tibiæ with silvery hair, but the tuft large and bright red (in *friesei* it is small and black). Abdomen strongly punctured.

♂.—Face-marks strongly yellow; clypeus yellow, coarsely punctured, with a smooth median line; lateral marks contiguous with clypeus, filling space between clypeus and eye, but ending before level of top of clypeus, the point toward orbit. Hind trochanters dentate; long hair at end of abdomen partly black, not red.

Cape Province: the female type taken at Ceres by Turner, Dec. 1924. There are five others from Ceres and one from Huguenot (*J. Ogilvie*), the latter with a well-defined clypeal stripe. Traces of the clypeal stripe can be seen in some of the Ceres specimens. The males are nine from Huguenot (*L. O.*, *J. O.*) and one from Ceres (*J. O.*).

The female suggests *A. friesei*, and is also allied to *A. clypeata* Brauns, which has on yellow marks on head, and the legs are partly fulvous. The male resembles *A. luteipennis* Friese, but has the abdomen all black and other differences.

Allodape elegantipes, sp. n.

♀.—Length about 8 mm., anterior wing 6.

Black, similar to *A. panurgoides*, with bright red hair covering hind tibiæ and tarsi, but sides of thorax with very scanty short pale hair, not the abundant red hair of *A. panurgoides*. It is also a little smaller than that species. Face-marks strongly yellow, the clypeal and lateral bands narrow and even; scutellum shining. Wings dilute reddish, not dark, stigma clear light yellowish red; basal nervure meeting nervulus; second cubital cell long, receiving first recurrent nervure more distant from base than second from apex.

Cape Province: Ceres (type-locality), Nov., Dec., 1920, Feb. 1921 (*Turner*). British Museum. Also one from Huguenot, Feb. 5–10 (*J. Ogilvie*).

Allodape bimaculata, sp. n.

♀.—Length about 7 mm., anterior wing 6.

Robust, shining black, with very scanty dull white hair; hind tibiæ and tarsi with silvery hair, the tibial patch brown. Clypeus depressed, finely punctured, dull, contrasting with the shining sides of face; face-marks yellowish white; clypeal stripe very slender, the upper end lacking; lateral marks narrow and of nearly even width; line behind orbits rather short; antennæ entirely black; mesothorax and scutellum shining, the latter with a small transverse yellowish-white mark at each side toward base; tegulæ very dark brown. Wings strongly suffused with brown, a greyish rather than reddish brown; stigma dark brown, outer nervures weak; basal nervure meeting nervulus; second cubital cell contracted above (*A. stellarum* style), receiving first recurrent nervure a moderate distance from base, second very near apex. Abdomen broad, margins of tergites wholly black.

Cape Province: Stellenbosch, Sept. 17, 1925 (*R. J. Nel*). Imperial Institute of Entomology.

Distinguished by the spots on scutellum, but in most respects related to *A. stellarum*.

GROUP OF *ALLODAPE PUNCTATA* (LEP. & SERV.).

Face of female with three longitudinal stripes. Scutellum yellow or spotted with yellow.

Allodape punctata (Lepeletier & Serville).

Cape Province: Montagu Pass (*L. O.*).

I find that the species sent to me by Friese (from Algoa Bay) as *A. hirsuta* Br. is really *A. crinita* Br. It does not at all agree with the description or the material under *A. hirsuta* in the British Museum. I am now satisfied that *A. hirsuta* is a synonym of *A. punctata*.

Allodape cordata rubricans, subsp. n.

♀.—Length 8 to 9 mm.

Similar to *A. cordata* Smith (*pernix* Bingh.), but hind margin of second tergite rather broadly and third to fifth very broadly dark red, the fifth and sixth practically all dusky red; basal nervure usually meeting nervulus (falling a little short of it in *A. cordata*); second cubital cell usually longer.

Pondoland: Port St. John, Sept. 1923, 24 females (*R. E. Turner*). British Museum. Natal: The Bluff, Durban, Oct. 15 (*L. Ogilvie*).

Near to *A. retrorsa* Strand, but considerably smaller. There is one Port St. John female, which I find has the abdomen as in *A. cordata*, but the longer cubital cell of *rubricans*. Compared with a Durban *A. cordata* it differs by the redder wings, with more slender red stigma and paler nervures. Compared with *A. c. rubricans* the stigma is much smaller and lighter, the wings are redder, and the nervures paler. The facial marks are orange and considerably broader. The basal nervure falls a little short of the nervulus. The hind tibiæ and tarsi have light yellowish hair, with a reddish patch on the tibiæ. Prothorax all black. This may be another race or closely allied species; for the present I call it *A. cordata* var. *rufipennis*, nov.

There is a single male from Port St. John, which has the abdomen as in *A. cordata*, but differs from var. *rufipennis* by the less reddened wings and darker stigma and nervures. The brush of hair at the end of the abdomen is very pale red. The basal nervure falls short of the nervulus. The clypeus is yellow and the yellow lateral marks are broad below, leaving the clypeus some distance above its lateral comma-like black marks. I can only call this *A. cordata*, but I suppose it to belong with the race *rubricans* in spite of the abdomen. I saw the type of *pernix* Bingh. (described as *Prosopis*) in the British Museum, and it is *A. cordata*. Specimens in the British Museum show that *A. cordata* goes north at least as far as Eshowe, Zululand (*Turner*), and it appears difficult or impossible to separate *A. junodi* Friese (female, not male) from Delagoa Bay.

Allodape communis, sp. n.

♀.—Length about 7 to 7·5 mm.

Light markings cream-colour, clypeal stripe very slender, mark on scutellum a narrow band, pointed at ends (in *A. cordata* a broad stripe, obtuse at ends); legs black, the tarsi obscurely reddish at end; wings dusky; basal nervure meeting nervulus or falling short of it; abdomen black, the hind margins of tergites not reddened. Prothorax entirely black.

Natal: Greytown (type-locality), Oct. 20, 15 females (*A. M.*, *Ckll.*, *J. O.*, *L. O.*); Amanzimtoti, Oct. 16, 1 female (*W. P. C.*). Pondoland; Port St. John, 10 females (*Turner*); Cape Province, Huguenot, 1 female, Feb. 5–10 (*J. O.*).

So far as my notes show, this is the species identified at the British Museum as *A. quadrilineata* (Cam.). It cannot, however, be the true *quadrilineata* (described under *Prosopis*), which, from the description, falls next to *A. carbonaria* Br., differing by the clear wings. I was inclined to regard it as a mere form or race of *A. cordata*, but now, having seen a long series, the average small size, different scutellar mark, and black abdomen appear to indicate a distinct species.

Allodape rufibasis, sp. n.

♀ (type).—About 7·5 mm. long, anterior wing 6, width of abdomen 2·3.

Head and thorax black, with cream-coloured markings, consisting of a narrow band on clypeus (not extended laterally at upper end), narrow bands along inner orbits, a stripe behind eye, and a crescentic mark on scutellum, broadly angulate in middle anteriorly; labrum, mandibles, and prothorax entirely black; antennæ black; legs black, the scopa on hind tibiæ white, the elongated patch on outer side dark brown (bright red in *A. vittaticeps*); abdomen with the second and third tergites and margin (or greater part) of first red; tergites 4 to 6 black; first sternite partly red, second and third red with black margin. Tegulæ dark, with a light spot. Wings dilute reddish fuliginous, stigma red, nervures black or nearly so; basal nervure falling a little short of nervulus; second cubital cell long, receiving first recurrent nervure far from base, the second nearer apex.

Closely allied to *A. vittaticeps* Ckll., but less robust, with narrower abdomen and smaller head, much narrower face-markings (the clypeal band not extended laterally at upper end), red of abdomen darker, hair of mesopleura shorter and not so white, nervures darker, scutellar mark generally smaller; clypeus less produced.

♂.—Length about 7 mm.

Robust, with dull pale yellow markings, consisting of all of clypeus (separated from lateral marks by a black sutural line), lateral marks (broad below, abruptly narrowed opposite upper part of clypeus and continued as narrow bands more than halfway up sides of front), narrow line behind eyes, and crescentic mark on scutellum; first tergite black, with margin (or only lateral margins) red, the dorsal tubercles prominent; second and third tergites chestnut-red, the others black; legs black; wings greyish hyaline.

The face-markings agree with those of *A. marleyi* Ckll., which is larger, with reddened wings and brighter red stigma. It is quite possible that *A. marleyi* and *A. vittaticeps* are sexes of one species, though the former is from Natal, the latter from Zululand.

Natal: National Park (type-locality), March 3–15, 2 females, 2 males (*A. Mackie, L. Ogilvie*); Van Reenen, Drakensberg, Dec. 1926, 1 female (*R. E. Turner*).

A. exoloma Strand seems to have been based on a mixture, but Strand is careful to cite the characters of the type-specimen, and it appears not to be *A. rufibasis*.

Allodape hæmatura, sp. n.

♀.—Length about 6·5 mm., anterior wing 5·5.

Head and thorax black, with dull yellow markings as follows:—Narrow band on clypeus, narrow bands along anterior orbits, narrow stripe behind eye, and also crescentic mark, angulate in middle anteriorly and not sharply pointed at sides on scutellum; labrum, mandibles, antennæ, tegulæ, and legs black; pubescence scanty, pale golden on hind legs; hind tibiæ posteriorly with a stripe of deep red hair; base of metathorax with a very large transversely oval dull depression; hair on tubercles and pleura reddish brown. Wings strongly brownish, inclining to grey, stigma dark reddish brown, nervures pallid; basal nervure falling barely short of nervulus; second cubital cell fairly long, receiving first recurrent nervure a fair distance from base, the second nearer apex. Abdomen broad, deep chestnut-red, neither apex nor base black.

Cape Province: north of George, November (*J. Ogilvie*).

In Friese's table this runs to *A. abdominalis* Brauns, which is considerably more robust, with much lighter red abdomen. Another specimen of *A. hæmatura* was taken at George (*J. Ogilvie*). One from Mossel Bay, October, looks different by the fuliginous wings, red stigma, slender mark on scutellum, and hair on hind legs paler, but I am sure it is only a variation. It was collected by R. E. Turner. Mossel Bay is about 30 miles from George. Another from Mossel Bay is even more distinct, the red of the abdomen extremely dark, the last two tergites practically black, wings strongly reddish, scutellar band narrow. It looks like a distinct species, but may be provisionally regarded as a variety only.

Allodape exoloma Strand.

Cape Province: Mossel Bay, Sept. 1921, 1 female (*R. E. Turner*).

A species remarkable for the very broad abdomen, the specimen larger than Strand's type, having the anterior wing nearly 8 mm. long, but in other respects so closely agreeing with the description that I cannot venture to separate it. The first tergite has the broad apical margin and the large sublateral bosses red; tergites 2 to 4 are red, 5 and 6 black; the last three sternites are black. There is a broadly triangular shining space at end of clypeus, below the yellow band.

Allodape semirufa, sp. n.

♀.—Length about 9 mm., anterior wing nearly 7, width of abdomen 3.

Robust; head and thorax black, with pale yellowish (rather ochreous tinted) markings, consisting of moderately broad stripe in middle of clypeus (not expanded at upper end), narrow lateral marks extending along orbits about halfway up front, narrow stripe behind eyes, and crescentic mark on scutellum, angulate in middle anteriorly; labrum, mandibles, antennæ, prothorax, and legs black, tarsi rufous apically; hair of pleura dull white; tegulæ translucent, with a small yellowish spot. Wings very strongly reddened, stigma large and red; basal nervure practically meeting nervulus; second cubital cell long, receiving first recurrent nervure further from base than second from apex; nervures brown, not very dark. Abdomen very broad, first tergite with a red margin; second bright chestnut-red, with the extreme base blackened; third with a red band across the middle; the others black, but all with narrow brown margins; venter black, largely red on basal half; hair of hind tibiæ and tarsi shining whitish, with a red stripe on tibiæ behind.

A second specimen (head lost) differs by having the third tergite dark red in the middle, with a large black cloud on each side. The area of metathorax is broadly dull in middle, with the margin shining.

Pondoland : Port St. John, Nov. 1923, and the variety, Jan. 1924 (*R. E. Turner*). British Museum.

Runs in Friese's table only to *A. abdominalis*, which is quite different, with clear red abdomen, though they agree in the shape of the broad abdomen. They are doubtless allied.

GROUP OF *ALLODAPE NIGROTHORACICA* FRIESE.

Rather large species, with red or partly red abdomen, black scutellum, and three yellow stripes on face of female. However, the black scutellum is not necessarily a specific character, and the group is to be merged with that of *A. punctata*.

Allodape centrimaculata Strand.

Cape Province : Mossel Bay, February 1922 (*Turner*).

♂.—With large black spot in middle of second tergite. The general colour of the abdomen is dark chestnut-red.

Allodape rufibasis var. *rufozonata*, nov.

♀.—Length about 8 mm., anterior wing 6·3.

Robust, head and thorax black; legs black, with white hair, tarsi obscurely brown apically; abdomen very broad, black at base and apex, the second and third tergites and hind margin of first bright chestnut-red, the first tergite on disc posteriorly having a pair of very large shining black bosses, which partly invade the red margin; wings strongly reddish, stigma light orange-ferruginous, nervures pale brown; labrum and mandibles black; a narrow yellow stripe running the whole length of the clypeus; yellow stripes along inner orbits, the lower portion broader than the clypeal stripe, the upper part running up sides of front, as broad as clypeal stripe, the upper end not directed inward; posterior orbits with a yellow stripe; prothorax, including tubercles, black; sides of thorax with much white hair; scutellum black, shining; basal nervure falling just short of nervulus; second cubital cell very long, receiving first recurrent nervure far from base, the second much nearer apex; venter with the basal half mainly red.

Natal: Van Reenen (5520 feet alt.), Drakensberg, Dec. 1926 (*Turner*). British Museum.

Nearly agrees with the description of *A. nigrothoracica* Friese, from Algoa Bay, but the hair of hind legs is not fulvous, and much more than basal half of first tergite is black. Considering the locality it is not likely to be a variation. Structurally it is much like *A. mediorufa* Ckll., but that has a pale band on scutellum. *A. rufibasis* Ckll. and *A. vittaticeps* Ckll. also have the long second cubital cell, but they have a yellow band on the scutellum. In spite of this difference on comparing types I conclude that the present insect is a variety of *A. rufibasis*.

TROPICAL *ALLODAPE* WITH RED OR YELLOWISH ABDOMEN.

Allodape vicina, sp. n.

♂ (type).—Length about 7 mm., anterior wing 5.

Robust, head and thorax black, the thorax with much greyish-white hair but no light markings; head entirely black except rather broad cream-coloured lateral marks (ending acutely on orbit a little below level of antennæ) and excessively fine linear marks along posterior orbits; antennæ entirely black; tegulæ dark brown. Wings hyaline, faintly dusky, stigma and nervures dark brown; basal nervure falling a long distance short of nervulus, second cubital cell receiving first recurrent nervure some distance from base, the second at apical corner. Legs black, with pale hair, small joints of tarsi rufous; hind trochanters with a long spine at base. Abdomen broad, chestnut-red; first tergite black except posterior and lateral margins; second tergite with a large black central patch; venter red.

♀.—Scutellum with a transverse yellow band, sharply pointed at each end; face with lateral marks having very faint, hardly visible, linear extensions upward to sides of front; clypeus with a narrowly cuneiform yellow mark on middle of lower half (in Albertville specimen also a little mark at upper end); first three tergites chestnut-red (no black mark on second), last three black.

Belgian Congo: Elisabethville (type-locality), one male and two females, females dated Aug. 21 and Nov. 30 (*Dr. M. Bequaert*); Albertville, female, December (*R. Mayné*). Congo Museum.

Allied to *A. abdominalis* Brauns, but with more reduced face-markings and black scutellum in the male. In *A. abdominalis* the number of red tergites varies. A "co-type" in British Museum has three, but I have Algoa Bay females from Brauns in which there are four and five red tergites. I thought at first that the sexes of *A. vicina* represented different species, but after close comparisons I decided that they must be associated. Friese described *A. junodi* as having the scutellum white in the female, black in the male, but he was not sure that he had correctly associated the sexes.

Also related to *A. vicina* are *A. semirufa*, *A. hæmatura*, and *A. rufibasis*, described above. These have the lateral marks extending well above level of antennæ and the median clypeal band complete (linear except in *A. semirufa*, which has it broader).

Allodape debilis, sp. n.

♀.—Length 4·5 to 5 mm.

Head and thorax shining black except that posteriorly and laterally the thorax is brown; head large, clypeus yellowish white, no lateral marks, light clypeal area broadly constricted in middle; mandibles black, labrum with a light spot; scape yellow in front; flagellum dark brown beneath; mesothorax reddish black; collar dark, but tubercles light. Wings dusky hyaline, stigma reddish brown, nervures pale; basal nervure falling far short of nervulus; second cubital cell receiving first recurrent nervure at basal corner, second far from apex; five hooks on hind wings. Legs pale brown or the femora black, hind tibiæ more or less dark and anterior tibiæ red in front. Abdomen pale reddish or yellowish brown, with black spots at sides of tergites 2 to 4 or 2 to 5.

Liberia: Du River, Camp no. 3, five females (*J. Bequaert*). Type in Congo Museum.

Allodape albolineata, sp. n.

♀.—Length 5 to 5·2 mm.

Similar to *A. debilis*, but labrum, mandibles, and lower corners of face pale red; narrow straight yellowish-white lateral face-marks, extending up to level of upper end of clypeus, but separated from clypeus by a dark band; clypeal mark not evidently constricted in middle; lateral corners of collar with a light spot; recurrent nervures about equally distant from ends of second cubital cell; legs entirely light red; abdomen red, with lateral spots on tergites 2 to 6, on 2 to 4 rather faintly continued across disc as bands, or (Lesse specimen) more evidently banded, the fourth tergite especially having a very broad narrowly interrupted black band; venter light red.

Belgian Congo: Walikale (type-locality), 1° 25′ S., 28° E., Jan. 1915 (*J. Bequaert*); Lesse, 0° 20′ N., 29° 40′ E., July 21, 1914, at flowers of *Bidens pilosa* (*J. Bequaert*). Type in Congo Museum.

This and the last recall *A. macula* Strand, but lack the stripes on mesonotum, and are considerably smaller.

Allodape picticauda, sp. n.

♀.—Length about 6 mm.

Rather slender, with fusiform abdomen (like a *Nomada*); head and thorax shining black; mesothorax without markings, but collar and tubercles white (the white continuous from collar to tubercles), sides of scutellum with narrow oblique pale reddish bands, yellowish white anteriorly; clypeus with a broad white band, a little enlarged at upper end; white lateral marks narrow and straight, following inner orbits to above level of antennæ; labrum pallid; mandibles dark, reddened apically; tegulæ large, hyaline. Wings ample, faintly brownish; stigma large, very dark; nervures light brown; basal nervure falling a little short of nervulus; second cubital cell receiving first recurrent nervure at basal corner, the second a short distance from apex. Anterior and middle legs clear light red; the front femora with a dark mark above; hind femora dark on upper side; hind tibiæ almost black, with pale reddish hair; hind tarsi red. Abdomen shining bright ferruginous above and below, the apical part above not beset with fine hairs; first two tergites with very broad black bands, strongly narrowed in middle; on first tergite the black is nearly confined to a pair of large bosses.

Belgian Congo: Walikale, Jan. 7, 1915 (*J. Bequaert*). Type in Congo Museum.

Resembles *A. macula monroviana* Ckll., but that has a broad abdomen, large pale marks on base of metathorax, discal lines on mesothorax, a greatly reduced clypeal mark, and lateral marks turned inward at upper end.

GROUP OF *ALLODAPE VARIEGATA* SMITH.

The following account refers to females unless the contrary is stated. The small species with red abdomen and a yellow mark on the scutellum form a little group which is hard to classify. The larger forms, usually about 7 mm. long, the hind legs with a copious pale reddish or whitish scopa, belong to *Allodape variegata* Smith in the broader sense. Typical *A. variegata* has the sides of abdomen above with dark spots or patches and the clypeal mark wide. The "*Prosopis*" *sandaracata* Bingham is precisely the same thing; indeed, both Smith's type and Bingham's carry the same sort of printed label, "NATAL," and must be from the same lot. We took the typical *A. variegata* on the Bluff, Durban, and I have it from Amanzimtoti, Natal (*Ckll.*), and Kloof, 1500 feet, Natal (*R. E. Turner*). A brownish specimen from Barberton, Transvaal (*Taylor*), is probably immature. Widely spread over South-Africa is another form, in which the abdomen lacks the dark spots. This was considered by F. Smith to be *A. variegata*, as shown by a specimen from his collection. Cameron and Brauns had manuscript names for it, but the descriptions were not published. I find that my recently published *A. bihamata* is of this type, and apparently this name must be used in a subspecific sense for the more widespread and common form of *A. variegata*. Friese (1924) refers to *A. pungens* Brauns as a synonym of *A. variegata*. Of this undescribed *A. pungens* I have six females and a male, collected by Brauns at Willowmore and Algoa Bay. Four females (Willowmore) are *A. minutissima* Ckll., but the other females are much larger and represent a form of *A. variegata* with unspotted abdomen. This (taking the Algoa Bay specimen as typical) differs from *A. bihamata* by the more produced clypeus and the lower part of the clypeal mark merely a little swollen, with no lateral points. On this basis a variety may be recognizable, but the examination of a very long series convinces me that the clypeal mark is very variable, and I do not know how to make any satisfactory division. Algoa Bay is practically the same locality as Port Elizabeth, the type-locality of *A. bihamata.*

Allodope variegata bihamata (Cockerell).

Transvaal: Louis Trichardt (*J. O.*, *A. M.*); Barberton, June 30, 1927 (*J. S. Taylor*). One of the specimens from Louis Trichardt has the abdomen mainly black, with a large red area on second tergite.

S. Rhodesia: Christmas Pass, Umtali (*A. M.*, *J. O.*, *L. O.*); Vumba, Umtali, four out of six with wings browner and legs darker than in Christmas Pass lot (*A. M.*, *J. O.*, *L. O.*).

Natal: National Park (*J. O.*); Van Reenen, Drakensberg (*Turner*); Weenen (*Thomasset*).

Pondoland: Port St. John (*Turner*).

Cape Province: near Oudtshoorn (*Ckll.*, *J. O.*); Mossel Bay (*Turner*); Queenstown, 3500 feet (*Turner*); Port Elizabeth (*A. M.*); near George (*W. P. C.*). One from Worcester (*Turner*) has the clypeal mark reduced to a small triangular spot on upper part.

In 1905 Cameron described *A. melanopus*, from Pearston, C.P., a locality in the interior about 100 miles north of Port Elizabeth and about 40 miles from Graaf-Reinet. I saw it in the British Museum, and it is easily distinguished from *A. variegata* Sm. and *A. jucunda* Sm. by the black hind legs. The anterior tibiæ and tarsi are rather dark red. The clypeal mark is dagger-like. This belongs with a series of small forms which, in typical specimens, may be separated as follows:—

Face all black; legs black, with anterior tibiæ in front and knees red-brown; labrum red-brown	*nigripes* Friese.
Face not all black	1.
1. Stigma clear red; wings clear hyaline; scopa of hind tibiæ yellowish white, but with stiff black hairs posteriorly	*minutissima* Ckll.
Stigma brown or black	2.
2. Middle tibiæ black; hind legs black; clypeus with dagger-shaped mark; second cubital cell short	*melanopus* Cam.
Middle tibiæ red	3.
3. Hind tibiæ black externally, with abundant black hair on posterior side; second cubital cell larger and longer; clypeal mark not confined to upper end	*ogilviei* Ckll.
Hind tibiæ with mainly pale hair; second cubital cell short; clypeal mark confined to upper end	*rufescens* Ckll.

In an earlier manuscript table I used the following characters :—

	Wings very clear, stigma red; second cubital cell strongly contracted above: very small species	*minutissima* Ckll.
	Wings not so clear, stigma dark; second cubital cell (except in *rufescens*) less contracted above.	1.
1.	Clypeal mark large, with a hook-like extension on each side at upper end	2.
	Clypeal mark small or obscure, no hook-like extension	3.
2.	Abdomen red, the tergites not marked with black.	*bihamata* Ckll.
	Abdomen with conspicuous black marks	*variegata* Sm.
3.	Smaller, wings clearer; abdomen dusky red, without black spots; basal areas of metathorax shorter than in *A. minutissima*	*rufescens* Ckll.
	Larger, wings not so clear; black spots at sides of tergites 1 and 2; hair on outer side of hind tibiæ black (tibial hair white in *bihamata*)	*ogilviei* Ckll.

These characters look well on paper, but on examining a very large series from various places much variability appears. *A. ogilviei* appears to be the more dominant form. The type-locality is Port Elizabeth.

Allodape ogilviei Cockerell.

Cape Province: Mossel Bay (*Turner*); near Oudtshoorn (*J. O.*, *W. P. C.*, *A. M.*, *Ckll.*); Knysna (*J. O.*). This represents a range of about 200 miles east and west, and about 30 north and south.

Allodape minutissima Cockerell.

Described from Oudtshoorn (type-locality) and Uitenhage. Brauns took it at Willowmore, between these two places. I have referred here specimens from Port Elizabeth (*A. M.*), the type-locality of *A. ogilviei*, and three from Mossel Bay (*Turner*) appear to go here, but they are divergent, having linear yellow lateral face-marks and the wings rather dusky. The characters distinguishing *A. minutissima* from *A. ogilviei* are more or less independently variable, and unless the males show more distinctive marks, it will probably be necessary to regard them as forms (more or less melanic) of one species.

Of *A. rufescens* I have a second specimen from Van Rhyns Pass (*L. O.*), in which the tubercles are almost entirely dark.

The clypeal mark in these bees, and particularly in *A. ogilviei*, tends to become more and more reduced until it is hardly visible, or even entirely absent. Thus we have a series of nine specimens, from three localities, in which the face is black. These ought to be *nigripes* of Friese, but they do not precisely agree. The black-faced forms separate out as follows :—

1. Middle tibiæ black, legs very dark, scape dusky or dark.
    - Labrum red; tibial scopa black behind. *nigripes* Friese.
    - Labrum black; tibial scopa pale, with little black hair (Milnerton, Cape Town, Jan. 1926, *R. E. Turner*) .... *nigripes* var. *milneri*, [nov.
2. Middle tibiæ red, tarsi red, labrum red, scape red in front.
    - Larger: hind tibiæ and tarsi with abundant long pale red hair (three from Mossel Bay, Feb., April, *Turner*). *variegata bihamata* var. [*atrifrons*, nov.
    - Smaller: hind tibiæ and basitarsi with much black hair behind (three from Mossel Bay, April, Sept., *Turner*) .. *ogilviei* var. *atrifrons*, [nov.

Some specimens of *A. ogilviei* from near Oudtshoorn are placed with the black-faced series, but they do have the clypeal mark very faintly and minutely indicated, as was the case with one of Friese's specimens of *A. nigripes*. Thus the question may be raised whether *A. ogilviei* is not in fact a subspecies of *A. nigripes*, which was described from numerous specimens from "Kapstadt" in the Cape Town Museum. The Mossel Bay material appears to indicate the independent development of melanism in the *bihamata* and *ogilviei* stocks. In *A. nigripes* var. *milneri* the tarsi are obscurely rufescent.

Whatever conclusion may be reached as to the number of valid species, it may apparently be said of the group that it shows strong melanic tendencies in the south-west corner of Africa and is least melanic in the dry interior. Yet there is no direct or uniform relation of this sort, the Mossel Bay and Oudtshoorn series, in particular, showing a wide range of divergence or variation. Also a specimen of *A. variegata bihamata* from Cape Town, April 4, 1920 (*Michael Bequaert*), has a very well-developed yellow supraclypeal mark in the form of a thick T, having the base broadened, and on it two little dark spots. This may represent a recognizable race.

A specimen from Port St. John, Pondoland (*Turner*), is very small (length about 5·6 mm.), but the pale red hair on the hind legs shows it is not *ogilviei.* It is a form of *A. variegata,* perhaps no more than an individual variation, and it agrees with a typical Durban specimen in the minute strap-shaped white hairs set at intervals on the last two tergites. *A. ogilviei* has on these tergites very minute simple hairs on a rugose surface. *A. rufescens* has fine sparse hairs; *A. minutissima* has smaller strap-shaped hairs.

A. jucunda Smith, the abdomen with four entire black bands, represents a subgroup allied to the group of *A. variegata.* Most nearly related to this is a remarkable xanthic species from Natal.

Allodape zaxantha, sp. n.

♀.—Length about 6·3 mm.

Head and thorax shining yellow (reddened by cyanide in type), with a broad black band across the vertex; about the posterior three-fifths of mesothorax black, except two widely separated parallel yellow lines, enlarged posteriorly, and yellow lateral margins; black marks in axillar region, black line at base of postscutellum, area of metathorax large and black; legs entirely yellow, their hair very pale yellowish; abdomen pale reddish fulvous, first tergite with a pair of round dusky spots; broad dark brown bands, narrowed in middle, on second and third tergites; a very broad subapical brownish-black band, involving sixth and apical part of fifth tergites; apex rather broadly black, but with a pale band before it; venter light orange, shining golden, a marginal black band at apex. Clypeus long, the lateral sutures marked by delicate black lines; scape yellow, flagellum very dark brown; head and thorax practically without hair; tegulæ hyaline. Wings clear hyaline, nervures pallid, the large stigma hyaline, with a dusky border; second cubital cell short, receiving first recurrent nervure a moderate distance from base. The suture between prothorax and mesothorax is black.

Natal: Weenen, Dec. 1927 (*H. P. Thomasset*). Imperial Institute of Entomology.

Readily known by the mainly yellow head and thorax. It is somewhat related to the tropical *A. macula* Strand.

Allodape pringlei Cameron.

The type-locality is Kokstad, which is in Griqualand, about 65 miles north of Port St. John. According to my notes at the British Museum the scutellum is black in the type, but Cameron describes a large bright lemon-yellow mark on scutellum. Brauns stated that his unpublished *A. pungens* was *A. pringlei*, but his specimens do not seem to fit Cameron's description. The small size, dark stigma, red scape, and infuscated hind tibiæ indicate the *A. ogilviei* type rather than *A. bihamata*, but the clypeal mark is said to be large, mushroom-shaped, dilated below but not so widely as above, while the base and apex of abdomen are blackish. Thus I conclude that *A. pringlei* included more than one thing, and the type was not identical with *A. ogilviei*, *bihamata*, or the *pungens* of Brauns.

The figures of "*A. pringlei*" (*pungens*) given by Brauns appear to indicate a banded abdomen, but I find this only in the male, which has the last tergite characteristically cream-coloured, as figured by Brauns. In attempting to determine which is the true *pungens* we have the difficulty that Friese in 1924 introduced the name as a synonym of *A. variegata*, while Brauns (1926) gave it as a synonym of *A pringlei.* The whole matter, as it stands at present, is highly complicated, and we must await further observations in South Africa.

XXI.—*Two new* Œstridæ (*Diptera*) *parasitic in African Antelopes.* By Major E. E. Austen, D.S.O.

The types and other material with which the following paper is concerned are in the British Museum (Natural History).

The author desires to express his sincere thanks to his friend and former colleague Mr. W. H. T. Tams, for his kindness in taking the photographs from which figs. 1 and 2 have been prepared.

Family Œstridæ.

Genus Gedoelstia Rodhain & Bequaert.

(Revue Zoologique Africaine, ii. pp. 173–176, 1913.)

In this genus, of which only two species have hitherto been described, the adults, while resembling those of

Œstrus in general appearance, are distinguished by the possession on each of the abdominal tergites from the second to the fourth inclusive of a pair of remarkable cockscomb-like crests (see fig. 2), of unknown significance. The larvæ are parasitic in the nasal and frontal sinuses of various African antelopes, and the typical series of the genotype of *G. cristata* Rodh. & Beq. (*loc. cit.* pp. 176–181, figs. 1–4, 1913), now in the Congo Museum at Tervueren, Belgium, were bred from larvæ found in the frontal sinuses of several *Bubalis lichtensteini* Peters, in S.W. Katanga, between the Rivers Lubudi and Lubilash. Of *G. paradoxa* Rodh. & Beq. (syn. *G. hässleri* Gedoelst), the second member of this genus to be brought to notice, the adult is as yet unknown, and the species is based on larvæ found in the heads of *Bubalis lelwel jacksoni* Thomas and *Damaliscus korrigum jimela* Matschie in the Uele and Kivu regions of Belgian Congo. The species described below is undoubtedly distinct from *G. cristata* Rodh. & Beq., of which the British Museum (Natural History) has recently received a female from Tanganyika Territory (*J. D. Scott* : presented by W. H. Potts). As shown by larval characters preserved in the puparium, not to speak of the differences in provenance, the subject of the present contribution is likewise specifically distinct from *G. paradoxa* Rodh. & Beq.

Gedoelstia impolita, sp. n.

♂♀.—Length, ♂ (one specimen) 13·25 mm., ♀ (two specimens) 12·8 mm. ; width of head, ♂ 5 mm., ♀ 4·75 to 5·25 mm. ; width of front (frons) at vertex, ♂ 1·75 mm., ♀ 2·75 to 3 mm. ; length of wing, ♂ 8·6 mm., ♀ 9 to 9·25 mm.

Closely resembling G. cristata *Rodh. & Beq.* (*the genotype*) *in coloration and general appearance, but distinguishable* inter alia, *apart from somewhat smaller size, in being entirely devoid of shining markings on dorsum of thorax.*

Head: face, jowls, frontal lunule, and anterior halves of parafrontals pale ochraceous-buff * or light buff, frontal stripe cinnamon-buff ; vertex ochraceous-orange, with a median, roughly quadrate, blackish-brown mark behind the shining black ocellar tubercles, narrower than corresponding mark in *G. cristata* and with its angles

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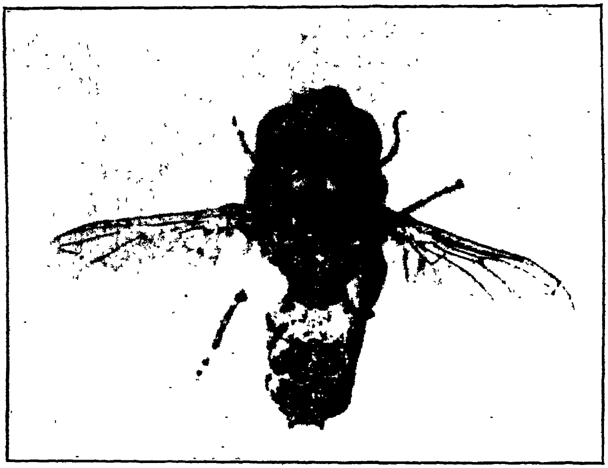
* For names and illustrations of colours used for descriptive purposes in the present paper, see Ridgway, 'Color Standards and Color Nomenclature' (Washington, D.C. : Published by the Author, 1912).

rounded; ocellar triangle shining, and enclosed within a Λ-shaped blackish-brown border; on each side of anterior portion of vertex and extending a little below it, resting on upper inner margin of corresponding eye, but not quite reaching apex of blackish-brown Λ, is a large blackish-brown transverse mark, more or less (especially in ♀) eroded by light buff pollinose patches; each parafacial with a series of usually four, but sometimes more, small mummy-brown or blackish-brown spots, for most part resting on inner margin of eye, uppermost spot the largest and elongate in shape; occiput (including posterior orbits, which are spotted and speckled with brown) pale olive-buff pollinose, with a large, blackish-brown, median mark extending downwards below vertex, and sending out from each upper angle a more or less triangular projection on to vertex itself; area on each side of median mark on occiput sparsely clothed with pale Naples-yellow hair; *antennæ* ochraceous-buff, first segment on inner side at base, and third segment on outer side blackish brown, arista light buff, mummy-brown, or blackish brown at base.

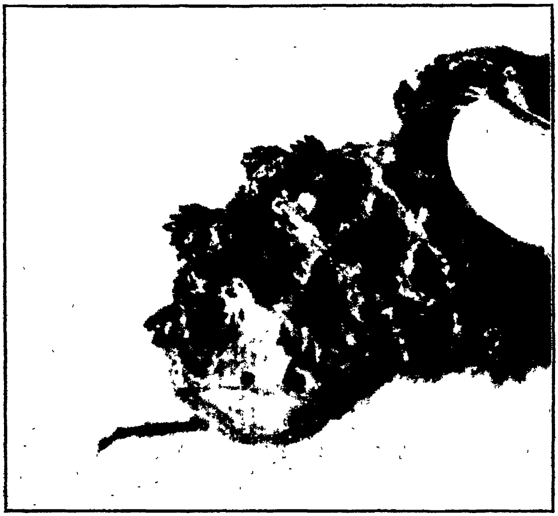
Fig. 1.



Gedoelstia impolita, sp. n., ♂. Much enlarged.

Thorax: ground-colour drab, dorsum of scutum speckled and marked with mummy-brown, and sparsely and patchily clothed with short, appressed, black hair, scutellum (at least its hind border) tinged with cinnamon; anterior portion of dorsum with a pair of short, parallel, admedian, longitudinal, mummy-brown stripes representing the shining black longitudinal wheals exhibited by *G. cristata*, and extending from front border two-thirds of way to transverse suture; dorsum of scutellum, sometimes except hind border, sprinkled with blackish-brown tubercles, and anteriorly with four, more or less distinct, blackish-brown quadrate marks resting on front margin; lower margin of hind border of scutellum also with small blackish-brown spots; mesopleuræ clothed with fine blackish-brown hair, longer on hind margin; hair on sternopleuræ ochraceous-tawny, that on mesosternum blackish brown in ♂, ochraceous-tawny in ♀.

Fig. 2.



Gedoelstia impolita, sp. n. Abdomen of ♂ type, viewed obliquely from right side, showing cockscomb-like crests. Much enlarged.

Abdomen silvery white, first three (visible) tergites heavily though irregularly marked with black or blackish brown on each side (see fig. 2), ground-colour of median area of second and third tergites in ♂ cinnamon-brown, median area of basal half of following tergite in ♂ slightly tinged with same colour; admedian crests on second and two following tergites blackish brown or black, each crest (as in *G. cristata*) resembling a miniature cockscomb, and terminating in from four to six or more backwardly directed conical denticulations, each tipped with a short fine hair; first (visible) tergite, in addition to black or blackish-brown markings already mentioned, with a pair of small, admedian, rounded, mummy-brown spots at base, and with its median area showing more or less distinct, though minute, speckles of similar colour; deflexed extremities of first four (visible) tergites sometimes each bearing a small blackish-brown spot, rounded or irregular in shape; ventrites clothed with fine ochraceous-buff hair.

Wings hyaline, distal extremity of third longitudinal vein, which bends forward to meet costa, less reflexed than in *G. cristata*, so that it joins costa more nearly at right angles, and submarginal cell at its distal extremity is more widely open, width of opening at tip of cell being equal to about 4/5ths of length of terminal portion of third vein, instead of to only 1/3rd, as in *G. cristata*; veins for most part isabella-coloured, anterior transverse vein and tip of auxiliary vein mummy-brown; as in *G. cristata*, several small speckles of blackish brown on veins near base of wing, and a small but conspicuous blackish-brown spot at base of anterior margin of alula. *Squamæ* dead white. *Halteres*: stalks ochraceous-buff, knobs mummy-brown.

Legs: coxæ, trochanters, and femora blackish brown, tips of femora, as well as a more or less distinct elongate area on inner side of front pair, and sometimes on inside of middle and hind pairs also, cinnamon or cinnamon-buff; tibiæ blackish brown, somewhat shining, pinkish-buff pollinose at base, and with similar, irregularly shaped, but often transverse, pollinose markings between base and tip, so that blackish-brown ground-colour is broken up into rounded spots or irregular, elongate blotches; tarsi cream-buff, tips of first four segments and base of terminal segment blackish brown; claws blackish brown, cream-buff at base; pulvilli cinnamon-buff; coxæ, trochanters, and to some extent under side of femora at base clothed with ochraceous-tawny hair, legs otherwise clothed entirely or mainly with black hair.

ZULULAND. Type of ♂, type of ♀, from the Black Umfulosi area, ix. 1923; one ♀ paratype, without more precise locality, 16. ii. 1923. All three specimens bred by *R. H. Harris*, from larvæ in frontal sinuses of blue wildebeeste (*Gorgon taurinus* Burchell), and presented, with two empty puparia, to the British Museum (Natural History) by the Imperial Institute of Entomology.

In addition to the differences already mentioned between the species described above and the genotype *G. cristata* Rodh. & Beq.—the only other species of *Gedoelstia* of which the adult is at present known—the new species may be distinguished from its congener by the interspaces between the mummy-brown spots on the posterior orbits being speckled with brown, and consequently less sharply defined; by the posterior border of the scutellum not being marked with two large and conspicuous mummy-brown blotches; and by the generally darker tibiæ.

Puparium.—Length (two specimens, one belonging to one of the types, the other to the paratype) after emergence of imago (*i. e.*, minus the anterior extremity) 14·25 to 15 mm.; greatest width 7·6 to 7·75 mm. Spiniferous segments each, quite regularly, with three rows of spines, occupying rather more than 1/3rd, or about 3/5ths, of the length of the segment.

Larva (3rd stage).—Thus the third stage larva of *G. impolita* has, on at any rate the majority of the spiniferous segments, three rows of spines. In a series of four third stage larvæ in the Museum collection, from the Uganda Protectorate, 3. ii. 1928 (*M. Graham*), from the nasal cavity of a female Topi (*Damaliscus korrigum jimela* Matschie), and apparently referable to *Gedoelstia paradoxa* Rodh. & Beq. (syn. *G. hässleri* Gedoelst), the spines on the 5th to 11th segments inclusive are in from three to four or even more rows, but are usually in four. These larvæ (preserved in alcohol) measure from 24·75 to 33·75 in length. According to Rodhain and Bequaert (Rev. Zool. Africaine, ii. p. 180, 1913), the ventral surface of the third stage larva of *G. cristata* Rodh. & Beq. has *two* rows of spines on the 3rd to the 12th segments, with the addition of an incomplete third row on the 8th and 9th.

Genus Œstrus Linnæus.

Œstrus regalis, sp. n.

♀.—Length (one specimen) 13 mm.; width of head 4·6 mm.; width of front (frons) at vertex 3 mm.; length of wing 9·4 mm.

In facies closely resembling Œ. ovis *Linn., but conspicuously large, and with front in ♀ more coarsely wrinkled, as well as less closely pitted than is usually the case in corresponding sex of that species; dorsum of thorax less hairy; first (visible) abdominal tergite with, on each side, a well-developed, black or blackish-brown, transverse lyrate mark.*

Head: front tawny-olive, frontal stripe sepia-coloured, frontal pits shining black at bottom and each bearing a blackish-brown hair; occiput, including posterior orbits, whitish-grey pollinose; upper part of each parafacial, and a small patch on each side of front resting on corresponding eye, whitish pollinose; frontal lunule cream-buff; lower border of antennary pits and upper part of clypeus ivory-yellow; central area of each half of face, between clypeus and parafacial, ochraceous-buff; jowls and lower portion of parafacials light buff; vertex with a median patch of tiny, black, piliferous tubercles immediately behind the globular ocellar tubercles, more concentrated and less dispersed than tubercles forming corresponding patch in case of *Œ. ovis*; pair of clove-brown marks on occiput below vertex darker and more clearly defined than corresponding marks usually are in *Œ. ovis*; five or six short dark brown hairs on upper part of each posterior orbit, forming a descending series, each hair standing on a small blackish-brown conical tubercle, more or less widely separated from its neighbours; first segment of *antennæ* cinnamon-buff, second segment cinnamon-coloured, third segment blackish brown, arista cinnamon-brown at base, then cream-buff.

Thorax: humeral calli and adjacent area of dorsum on each side whitish-grey pollinose, ground-colour of remainder of dorsum, including scutellum, greyish drab; dorsum covered with shining black, rounded tubercles, very small on anterior portion (from fore border to some little distance beyond transverse suture), and there aggregated together to form the admedian interrupted stripes and other markings seen in *Œ. ovis*, larger and more scattered on median area of hind portion of scutum and scutellum; humeral calli and lateral borders of dorsum in front of transverse suture clothed with dark brown or blackish-brown hair, and each tubercle bearing a short, recurved, blackish-brown hair, dorsum otherwise bare; pleuræ and pectus cinnamon-brown, with a greyish pollinose covering, and clothed for most part with fine, glistening, reddish-brown hair, with in addition some ochreous hair on sterno- and pteropleuræ.

Abdomen silvery white, tergites, except deflexed extremities, with irregular, somewhat shimmering, black or blackish-brown markings, largest and most conspicuous on each side of first and second (visible) tergites, where they are more or less distinctly lyrate; hind borders of ventrites cream-buff, each visible ventrite with a large and conspicuous black median mark, transversely oblong, semicircular, or scutiform in shape, extending nearer to hind margin than to base in each case, but not reaching either posterior or lateral margins; central area of tergites thinly clothed with short, recurved, black hairs, hind borders of last two (visible) tergites with longer black hairs; ventrites and deflexed extremities of tergites clothed with yellowish hair; anterior border of first (visible) tergite clothed on each side with whitish hair.

Wings agreeing in venation with those of *Œ. ovis*, except that first posterior cell is somewhat broader in proportion to its length, and more bluntly truncated at its distal extremity, and that terminal section of third longitudinal vein (beyond first posterior cell) is straighter, *i. e.*, not so much curved towards costa; veins for most part cinnamon-buff, anterior transverse and adjacent portion of fourth longitudinal vein blackish brown. *Squamæ* waxen white. *Halteres* light ochraceous-buff.

Legs: femora and tibiæ shining, femora cinnamon-brown, their tips light buff or cream-buff; tibiæ light ochraceous-tawny; tarsi light ochraceous-buff; femora clothed with dark brown hair, tibiæ and tarsi with blackish-brown or black hair and bristles; distal extremities of claws black, pulvilli and proximal halves or two-thirds of claws cinnamon-buff.

ANGLO-EGYPTIAN SUDAN. Holotype ♀ from the Dinka country, near Kongor, 25. v. 1909 (*H. H. King*). The collector's field-note on this specimen is as follows:—

"Bred from larva taken from the frontal sinuses of a tiang (*Damaliscus korrigum tiang* Heuglin) killed near Kongor on the R. Atem, which joins the Bahr-el-Gebel south of Shambe. This specimen spent 34 days as a pupa. A tiang killed at Kio, 4. vi. 1909, harboured larvæ of all sizes."

Although none of the larvæ just mentioned are available for comparison, there can be no doubt that the fly just described, in spite of its strong superficial resemblance to *Œstrus ovis* Linn., is specifically distinct. Apart from the other differences to which reference is made above, this is proved at once by the extreme shortness and sparseness of the hairy covering of the dorsum of the thorax, as compared with the much longer, finer, and paler hair clothing the corresponding region in *Œ. ovis.*

What may well be the male sex of *Œstrus regalis* is represented by a solitary ♂ from Tanganyika Territory (Shinyanga District, Miwamira, 24. vi. 1926, "in tent": *W. H. Potts*). This specimen, which is larger than the type of *Œ. regalis* and measures 14·2 mm. in length (length of wing 10·6 mm.), has more closely pitted parafrontals (a corresponding sexual difference is exhibited by *Œ. ovis*) and longer and finer hair on the dorsum of the thorax. The abdominal markings, both dorsal and ventral, present general agreement with those exhibited by the type of the species described above, while a certain discrepancy in the venation, due to the greater length of the first posterior cell, has its counterpart in a similar sexual difference exhibited by *Œ. ovis.* The thorax of the insect is, however, very greasy, and has defied all attempts to effect an improvement by means of benzole. It therefore seems advisable to postpone final decision as to the specific identity of this specimen until the receipt of further material.

XXII.—*Descriptions and Records of Bees.*—CXLIX.

By T. D. A. Cockerell, University of Colorado.

The following South African species of *Allodape* have the scutellum black, the abdomen red or reddish, and the face of the female not trifasciate.

The Group of Allodape dichroa *Strand.*

Allodape dichroa Strand.

Natal: National Park, March 3–15, both sexes (*A. M.*, *J. O.*, *L. O.*); Zululand; Eshowe.

♀, March (*Turner*). Described from "Kapland."

From Weenen, Natal (*Thomasset*), come a female and three males; two of the males unusually small, and all peculiar by having linear lateral face-marks contiguous with the lower part of clypeus. This is *A. malleifera* Ckll., 1916, which must apparently stand as *A. dichroa malleifera.* Strand's publication is dated 1914, but it did not reach me until much later. The 'Zoological Record' dates it 1915, but does not record it until the volume for 1921. It is evident that *dichroa* and *malleifera* are not different species.

Allodape aliceæ Cockerell.

Cape Province: Mossel Bay, 7 ♀, 1 ♂ (*Turner*).

Females taken in March, April, and October (indicating two broods); male, September. The male is referred here on account of the small dusky wings, with relatively small stigma, the cream-coloured clypeus (with no light bands laterad of its upper end), and the brownish-black legs, with lighter brown (not red) tarsi. The abdomen, however, has broad dusky bands, though the apex is broadly light red except at extreme sides. Labrum cream-coloured, but mandibles black; upper border of prothorax wholly dark, but tubercles light. Scape light in front. This is nearest to *A. nigricollis* Friese, 1924 (not Vachal, 1903), which may be called *A. atricollis*, n. n.

The following males, superficially like *A. aliceæ*, come nearest to *A. nigrescens* Friese and *A. palliceps* Friese, but cannot be identified with either. None has the deep median depression or scutellum characteristic of *A. foveiscutis* Cameron (type examined in British Museum). All have well-developed lateral face-marks, so that there is a band on each side of upper part of clypeus, and all have the labrum and mandibles light.

Abdomen dark, suffusedly reddened on second, third, fourth, and sixth tergites; femora black, with red spot on knees; tarsi and anterior and middle tibiæ pale reddish; hind tibiæ black, broadly reddish at end.... *brunnescens*, sp. n.

Abdomen red, with the apical part suffusedly dusky or blackened at sides, or all red, but never black ; hind tibiæ always clear red ..	1.
1. Anterior and middle femora and all tibiæ and tarsi clear red ; face narrower	*coloratipes*, sp. n.
Anterior and middle femora at least largely black ; face broader	2.
2. Anterior and middle femora black, red at extreme apex	*latifrons*, sp. n.
Anterior and middle femora with more than apical half red	*rufula*, sp. n.

Male *A. pungens*, from Willowmore (*Brauns*), has the scutellum and metathorax pale brown. The legs also are pale brown, without any black. The face-marks and yellow mandibles and labrum are as in the above species. In spite of the black scutellum, it seems not impossible that some of these small males may belong with females of the *A. variegata* group *.

A male from Weenen, Natal (*Thomasset*), resembles the Brauns *A. pungens*, but is conspicuously more robust, with broader face, and the abdomen is darker. This practically agrees with Friese's account of supposed male of *A. nigrescens* from Algoa Bay. A male from Mossel Bay (*Turner*) has the scutellum broadly yellow, margined at sides. The legs are bright ferruginous, except that the hind femora are black, with the ends red ; the apical part of abdomen is dusky but not black. The stigma is large and dark. Compared with the type of *A. ogilviei* the nervures are much paler and the second cubital cell is shorter. The hair on hind tibiæ and tarsi is entirely pale. In spite of the yellow marks on scutellum, I take this to be conspecific with *A. coloratipes*.

Allodape brunnescens, sp. n.

♂.—Length 5·5 mm.

Entire face, labrum, mandibles except tips, scape in front, interrupted band on prothorax, and tubercles all cream-colour ; upper border of light colour on face straight and sharp, but lateral bands extending a short distance beyond ; there is no black between lateral marks and clypeus ; flagellum dusky brown beneath ; scutellum convex, highly polished. Wings hyaline, with large brown stigma and brown nervures ; second cubital cell rather long. Femora black, with the knees narrowly red; hind tibiæ black, red at end, and with much white hair; the other tibiæ and all the tarsi red. Abdomen very dark reddish, the fourth tergite black, but not sharply contrasting; hair at apex clear white; venter reddish, with the fourth and fifth sternites practically black, contrasting with those before and behind them.

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* Brauns (1926) stated that species with spotted scutellum may vary in certain cases, to having the scutellum all black.

Cape Province: Willowmore, July 3–8, 1920 (*Turner*). British Museum.

Allodape coloratipes, sp. n.

♂.—Length about 5 mm.

Face, labrum, mandibles, scape in front, band on prothorax, and tubercles all pale yellow; yellow of face ending squarely at top of clypeus, but lateral bands going some distance beyond (further than in *A. brunnescens*), and a pointed projection of black on each side of upper end of clypeus, where the lateral bands diverge; flagellum black. Wings greyish hyaline; stigma large and brown, nervures brown; second cubital cell large but rather short. Legs clear bright ferruginous, with the hind femora black, broadly red at each end. Abdomen dusky red above, without black, beneath bright chestnut-red; a blackish mark at each side of second sternite.

Cape Province: Mossel Bay, March–April 1930 (*Turner*). British Museum.

Allodape latifrons, sp. n.

♂.—Length 5·5 to 6 mm.

Similar to the last, but face broader, chrome-yellow, the lateral marks hardly produced beyond level of top of clypeus, but black notch between them and clypeus very well developed; prothorax entirely black except that tubercles are yellow, or the upper border of prothorax may have a small light mark at each side. Wings brownish hyaline, with very large brown stigma and pale brown nervures; basal nervure falling short of nervulus; second cubital cell receiving recurrent nervures equally distant from base and apex. Femora black, with the knees red; tibiæ and tarsi bright ferruginous. Abdomen chestnut-red, the first tergite blackened on disc, sides near apex suffusedly blackish; venter bright red.

Cape Province: three from Mossel Bay, April (type) and October, 1921 (*Turner*). British Museum.

Allodape rufula, sp. n.

♂.—Length about 5 mm.

Similar to the last, and perhaps only racially distinct, but all the femora broadly red apically, the anterior ones rather more than half red, the middle ones black only at base. Face-marks decidedly yellow, lateral marks extending considerably above level of clypeus; scape yellow in front, but flagellum black; yellow band of prothorax well developed and entire. Wings hyaline, stigma darker and not so large as in *A. latifrons*; second cubital cell large, receiving first recurrent nervure at extreme basal corner, second some distance from apex. Abdomen bright chestnut-red, descending part of first tergite dark; sides of subapical region broadly and conspicuously blackened; venter clear red.

S. Rhodesia: Christmas Pass, Umtali, May 20–21, 1932 (*J. Ogilvie*).

The following small species, mostly from Pondoland, are quite distinct from those described above:—

Male, without lateral face-marks along upper part of orbits; upper border of prothorax all black; hind tibiæ black, but the basitarsi clear yellow .... *basipicta* Ckll.

Females .... 1.

1. Anterior tibiæ red .... 2.

Anterior tibiæ not red or only so apically; upper border of prothorax all black; stigma pallid, with a dark margin (in *A. aliceæ* Ckll. it is solid dark brown) .... 4.

2. Upper border of prothorax black; very small narrow species .... *angustula* Ckll.

Upper border of prothorax marked with yellow .... 3.

3. Hind tibiæ black (red at end), with copious white hair; middle tibiæ black in middle and red or yellow at each end .... *megastigma* Ckll.

Hind tibiæ black (a small bright red spot at end), the outer side with much black hair; middle tibiæ black, very narrowly red at each end; stigma much darker .... *turneri* Ckll.

4. Face-mark with upper part broadly quadrate, lower part a broad band; hind tibiæ dull red, with much long shining plumose entirely pale hair .... *quadratifera* Ckll.

Face-mark dagger-like; hind tibiæ black.... 5.

5. Abdomen strongly dusky, partly brown; base of first tergite with a pallid spot at each side. *obscurescens* Ckll.

Abdomen red, more dusky apically .... *clarior* Ckll.

Allodape basipicta, sp. n.

♂.—Length about 5·3 mm.

Head and thorax shining black; head large, with very prominent eyes; face narrow; clypeus bright yellow, the yellow area deeply constricted at sides; no lateral face-marks except minute crescentic ones contiguous with lower part of clypeus; labrum yellow; mandibles black; scape light yellow in front, flagellum obscurely reddish below; upper border of prothorax black, but tubercles yellow; scutellum ordinary, not foveate. Wings greyish hyaline, stigma not very large, solid brown, nervures pale brown; second cubital cell receiving recurrent nervures equally far (not very distant from) base and apex. Legs black, with yellow basitarsi, and small joints of tarsi pale rufous; the contrast between the black hind tibiæ and light lemon-yellow basitarsi is very striking. Abdomen red, with broad blackish bands on tergites 4 to 6, the apex bright red; the band on fourth tergite is evanescent in middle; base of first tergite on each side with a pyriform pale mark broadly surrounded by black, these markings being very distinctive; venter bright chestnut-red.

Pondoland: Port St. John, March 1924 (*Turner*). British Museum.

I cannot associate this with any female at present. *A. obscurescens* might be a candidate, on account of the pallid spots at base of first tergite, but the wings are quite different, with much darker nervures, and hyaline, dark-bordered stigma.

Allodape megastigma, sp. n.

♀.—Length about 5·5 mm.

Head and thorax black, with yellow markings (reddened by cyanide in type); clypeal mark extending right across upper part of clypeus, but the lower portion a broad band, gradually narrowing below; labrum yellow; mandibles dark, obscurely reddened subapically; scape narrowly yellow in front, flagellum dusky red beneath; area of metathorax large, minutely lineolate; upper border of prothorax with a yellow mark on each side and tubercles yellow. Wings hyaline, stigma large, dilute brown; nervures pale, second cubital cell long, receiving recurrent nervures near to (about equally distant from) base and apex. Femora black, with the knees red; tarsi and anterior tibiæ bright red; middle tibiæ broadly red at base and apex; hind tibiæ black, red at end, with white hair. Abdomen with first tergite brownish black, second and third blackish, with base and apex reddened, the remaining ones nearly black, the general effect dark reddish; venter lighter red, with the apical portion broadly black.

Pondoland: Port St. John, Nov. 1923 (*Turner*). British Museum.

Allodape angustula, sp. n.

♀.—Length about 4 mm.

Very small and narrow; head and thorax shining black, the scutellum polished, not foveate; clypeal mark cream-colour, broadly cuneiform; labrum dark red, with large punctures; mandibles black; collar black, the tubercles obscurely pallid. Wings hyaline, slightly dusky, stigma solid brown; nervures pallid; second cubital cell receiving first recurrent nervure not very far from base, the second more distant from apex. Legs black, obscurely rufescent at end, hair of hind tibiæ and tarsi pale reddish. Abdomen dusky red above and below, blackened basally. The anterior tibiæ are red in front, but dark behind.

Cape Province: George, Nov. 4–7, 1931 (*J. Ogilvie*).

Much smaller than *A. aliceæ* and with different venation.

Allodape turneri, sp. n.

♀.—Length about 5·3 mm.

Head and thorax shining black, with rather dull yellow markings, the clypeal mark expanded equally above and below, the median portion a broad band; labrum slightly reddish, mandibles black; scape long, red beneath, flagellum black; marks at sides of collar and tubercles yellow. Legs black, with anterior tibiæ bright chestnut-red, their tarsi also red; middle and hind knees with a small red spot and a spot at end of hind tibiæ; middle and hind tarsi pale reddish apically; hind tibiæ black, posteriorly with much black hair. Abdomen bright chestnut-red, not black at end, but the descending base black. Wings brownish hyaline, the stigma large and solid, dark brown; nervures brown; second cubital cell high and short, receiving first recurrent nervure at basal corner, the second near apex.

Cape Peninsula: Camps Bay, April 1920 (*Turner*). British Museum.

Allied to *A. ogilviei*, but that has clear red middle tibiæ and a large yellow mark on scutellum.

Allodape quadratifera, sp. n.

♀.—Length about 5·3 mm.

Head and thorax shining black, with chrome-yellow markings; clypeal mark broadly quadrate (this portion broader than long) above, the lower part a broad band, not expanded below; labrum and mandibles black; scape yellow in front, flagellum black; collar black, but tubercles yellow. Wings dusky; stigma rather large, pale brownish with a dark margin; second cubital cell large but short, receiving recurrent nervures equally distant from base and apex. Legs black, with dusky red tarsi; anterior tibiæ broadly rufous apically, middle tibiæ the same, hind tibiæ red, with pale hair. Abdomen dusky red, not black at end, but the base blackened.

Pondoland: Port St. John, May 1924 (*Turner*). British Museum.

The entirely black tibiæ readily separate the related *A. clarior*. *A. obscurescens* is also easily separated by the dark outer nervures.

Allodape obscurescens, sp. n.

♀.—Length about 5·3 mm.

Head and thorax shining black; clypeal mark clear yellow, broad at upper end, and with a median stripe narrowing below, a little notch on each side at junction of median stripe with transverse band; labrum and mandibles black, scape entirely black, flagellum dark reddish beneath; collar black, but tubercles yellow; scutellum ordinary, with scattered extremely minute punctures. Wings brownish, clear beyond the cells; stigma pallid, with a dark margin; nervures dark; second cubital cell receiving first recurrent nervure a considerable distance from base, second very near apex. Legs black, with pale reddish tarsi; hind tibiæ and tarsi with abundant silvery hair. First tergite mostly very dark, but a pale reddish mark on each side near base and apical margin reddish; second tergite red with a black band, strongest at sides; third and fourth tergites dusky reddish, with broad black hind margin, sixth tergite black; venter chestnut-red; last three tergites with sparse fine white hair.

Pondoland: Port St. John, Sept. 1923 (*Turner*). British Museum.

Allodape clarior, sp. n.

♀.—Length hardly 5 mm.

Head and thorax shining black; clypeal mark (reddened by cyanide in type) dagger-like, with broad upper end, the transverse bar forming right angles with the median stripe, the whole surface very finely punctured; labrum, mandibles, and collar black, tubercles yellow; scape with a red stripe in front, flagellum dusky rufous beneath. Wings brownish hyaline, of the same tint throughout; stigma reddish brown, with a dusky margin; the general effect quite dark; nervures brown; second cubital cell receiving first recurrent nervure rather near base, the second more remote from apex. Legs black, with small joints of tarsi rufous; hind tibiæ and tarsi with much long white hair. Abdomen chestnut-red, black at extreme base, the apical part dusky, with fine white hair.

Pondoland: Port St. John, Nov. 1923 (*Turner*). British Museum.

There is still another species collected by Turner at Port St. John—a female with dark brown legs, the hind tibiæ and tarsi paler brown, speckled with black. The specimen is in poor condition and perhaps not fully matured. It nearly fits the description of *A. nigricollis* Friese, but is too small.

XXIII.—*Notes on the Nomenclature and Systematic Position of some African Mammals. By* Ernst Schwarz. From the Zoological Department, British Museum (Nat. Hist.).

1. *Papio comatus comatus* E. Geoffroy.

In checking the original description of *Simia porcaria* Brünnich, which was published in a rare book of which Dr. C. D. Sherborn has kindly shown me his private copy, I find that the description, accompanied by an excellent coloured plate, is not applicable to the Chacma baboon, but to the Malay pig-tailed monkey, *Macaca* *nemestrina* Linnæus. The next name usually quoted as belonging to the Cape baboon is *Simia sphingiola* Hermann. The type was a mounted specimen in the Strasbourg Museum; Dr. A. Burr, the present curator, very kindly made inquiries for me, and found that it is no longer preserved, although it was in the collection as late as 1871; the entry in the MS. catalogue states, "*Macacus cynomolgus* Desm. (*sphingiola* Herm.), Sumatra, Cab. Hermann." Hermann's name therefore being equally inapplicable, the third name given to this species, *Papio comatus* E. Geoffroy, becomes available. The two specimens mentioned by I. Geoffroy-St. Hilaire in his 1851 catalogue of the primates in the Paris Museum have been in that institution for a long time. They were (1) an old male without history, but as I learn from Professor Bourdelle with a handwritten inscription "Babouin chevelu" which is still in existence; (2) the second specimen, brought from the Cape in 1804 by Péron and Lesueur has disappeared. It is therefore highly probable that the mounted specimen is the type of *comatus*, the inscription being in accordance with the French name used by E. Geoffroy for this species. The following is a brief account of the literature:

(1782. *Simia porcaria* Brünnich, Dyrenes Historie, l. p. 13, Tab. i.)
(1804. *Simia sphingiola* Hermann, Obs. Zool. p. 2.)
1812. *Papio comatus* E. Geoffroy, Ann. Mus. Hist. Nat. xix. p. 103.

Through the kindness of Professor H. A. Dart of Johannesburg, I have recently had an opportunity of examining three of the skulls studied and named by Goldblatt *. They are not the specimens figured, and, apparently, it has not been possible to trace them. But as no types have originally been described, and the specimens before me belong to the original series, I can see no reason why they should not be selected as types. I, therefore, herewith designate the following lectotypes:

1. *Papio porcarius occidentalis* Goldblatt, Department of Anatomy, University of the Witwatersrand, No. Bl., Old male; Rustenburg, Transvaal; skull.
2. *Papio porcarius orientalis* Goldblatt, same collection, No. B 3, Old male; Queenstown, Eastern Cape Province; skull.

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* S. Afr. Journ. Soc. xxiii. pp. 64–83, pl. xvi. (1926).

I have not been able to confirm Goldblatt's results in the material at hand. The differences pointed out by him are largely individual, and in animals which are so much subjected to environmental influence would appear to be of the modification type. Both of Goldblatt's supposed subspecies, therefore, will have to be regarded as synonyms of *Papio comatus comatus* E. Geoffroy.

Papio comatus griseipes Pocock.—The baboon inhabiting the region north of the Limpopo River will have to stand as *Papio comatus griseipes* Pocock [*]. The original locality was given as Potchefstroom, North Transvaal, but this locality is certainly wrong. The type agrees well with the Rhodesian baboon, and, as it was a living specimen, may have been brought from farther north. The exact limits of the range of this form are not known at present. Apparently it crosses the Limpopo River near the Messina Mine, from where Zukowksy's *transvaalensis* [†] has been described. I have seen specimens from various places in South Rhodesia (Chirinda Forest, Umvukwe Mts., Mashonaland, Kabulabula, west of Livingstone), and Portuguese East Africa (Coguno, Inhambane; Tambarara, Gorongoza Mts.; Lourenço Marques). Haagner [‡] records it from the Kafue Flats, and I now think that the specimen described by myself as *Papio cynocephalus jubilæus* [§] from the Capotche district, north of the Zambesi, also belongs here. It is, therefore, apparent that *transvaalensis* Zukowsky, *rhodesiæ* Haagner, and *jubilæus* Schwarz are synonyms of *Papio comatus griseipes* Pocock. I also now think that *P. cynocephalus* and *P. comatus* should be regarded as separate species.

As regards *Simia sphingiola* Hermann, I am not prepared to accept it, but, in the absence of a type-specimen, regard it as undefinable. Its revival would mean another upsetting of the name for the common crab-eating monkey now designated as *Cynamolgus irus* G. Cuvier, but long known as "*Macacus cynomolgus.*"

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[*] P. Z. S. 1911, p. 558 (1911); also Abstr. P. Z. S. 1911, no. 93, p. 17 .3.1911).

Hagenbeck's Ill. Tier- und Menschenwelt, ii. p. 57 (1927).

[‡] S. Afr. Mamm. p. 17 (1920).

Zeitschr. Säugetierk. iii. p. 211 (1928).

2. *Civettictis civetta schwarzi* Cabrera.

The locality of the East African civet described by Matschie (Arch. Nat. lvii. Abt. 1, p. 352, 1891) as *Viverra civetta orientalis*, a name later changed into *Civettictis civetta schwarzi* by Cabrera (Mem. R. Soc. Esp. Hist. Nat. xvi. no. 1 *a*, p. 36, 1929), was given as Zanzibar and Bagamoyo. I hereby definitely fix Zanzibar as the type-locality, and the specimen in the Berlin Museum collected by Hildebrandt as the type. It remains to be seen whether the insular specimens represent a different race from the mainland one.

3. *Hippopotamus amphibius capensis* Desmoulins.

Since my revision of the literature relating to this genus (Erg. Zweit. Deutsch. Zentr. Afr. Exp., Zool. i. p. 873, 1920), I have found that *Hippopotamus capensis* was first published in 1825 and that its author is Desmoulins, not Lesson. In the first publication mention is made of a communication to the Société Philomatique de Paris on March 25th, 1825 ; but, apparently owing to a conflict with Cuvier, this paper was never printed in the Bulletin of that society, but was brought out at the end of the year, probably in November or December, in F. Magendie's 'Journal de Physiologie expérimentale et pathologique,' v. pp. 354–366 (1825). The actual date of *capensis* is not this paper, but the article on hippopotamus in the 'Dictionnaire Classique,' written by Desmoulins. The full quotation is :—

1825. *Hippopotamus capensis* Desmoulins, Dict. Class. Hist. Nat. viii. p. 220.

The species is founded on Delalande's specimen in the Paris Museum, which was obtained on the lower Berg River in Western Cape Province (Mém. Mus. Hist. Nat. vii. p. 154, 1822).

The Senegal hippopotamus was described in the same place as *Hippopotamus senegalensis*.

XXIV.—*Two new* Elateridæ *from Melanesia.* By R. H. Van Zwaluwenburg (Experiment Station of the Hawaiian Sugar Planters' Association).

Tetrigus silvaticus, sp. n.

Female, 13·0 mm. long, 3·0 mm. wide.

Dark reddish brown, with antennæ and greater part of the elytra lighter reddish brown, the elytra with vague darker maculations on the dorsum just behind the basal declivity and along the lateral margins. Covered on the dorsum with a rather coarse, recumbent, brownish pubescence; finer on the ventral surface. Colour beneath uniformly dark brown.

Front shallowly concave; broadly rounded on anterior margin; finely and closely punctulate. Antennæ not attaining the basal margin of the prothorax; joints 2 and 3 globular, subequal; 4–10 serrate, the serrations so produced on the first few segments as to be almost sublamellate, but becoming progressively weaker as the distal joints are approached; the antennæ very similar to, but less robust than, those of *T. fleutiauxi* ('Stylops,' vol. ii. pt. 8, p. 176, fig. 1, Aug. 1933); eleventh joint elongate, entire.

Pronotum in cross-section markedly convex, slightly depressed on the sides; finely and closely punctulate; longer than wide (about as 3·5 to 3); sides faintly arcuate along middle; slightly wider at the anterior one-fifth where the outline narrows to the anterior margin than at base of the posterior angles. The posterior angles are stout, diverging slightly from the general outline; definitely unicarinate. No trace of median channel, even basally. Prosternal epipleuræ transversely concave; prosternal lobe rounded medianly with a short blunt spine on either side. Mucro slightly undulate, subhorizontal. Mesosternal cavity with posterior margins horizontal, thence anteriorly with a very short declivity and nearly horizontal for the remainder of its length. Scutellum flat, elongate, subacute posteriorly; sharply declivous.

Elytra with abrupt, evenly curved, basal declivity; very convex in cross-section, especially on basal half; narrower than the prothorax; sides subparallel to beyond the middle, thence sharply and conjointly narrowed to the apex; abruptly divergent from the sutural margin near the apex, terminating in a short acumination. Striæ consisting of fine, lightly-impressed punctures, obsolescent on the basal declivity; intervals nearly flat, finely punctulate.

Posterior coxal plates wider externally than at middle; widening abruptly on their inner third. Tarsi simple.

Described from a holotype female, Vunidawa, Fiji, *H. Phillips*, i., ii. 1932. The type is in the British Museum. Vunidawa is a district lying well up the Rewa River on the island of Viti Levu; it is a heavily forested region lying at about 2000 feet elevation.

This species resembles in certain respects *T. fleutiauxi* from Ongeandriti, Fiji, but the general *facies* is very different, and the structure of the mesosternal cavity clearly separates the two.

Propsephus compactus, sp. n.

Male, 8·0–8·5 mm. long, 2·7–2·8 mm. wide.

Form stout, rectangular, narrowed in front and rear. Shiny; dark brown with elytra somewhat more reddish than head and pronotum; antennæ reddish, legs yellowish, brown. Pubescence fine, semi-erect, brownish. Colour beneath more or less uniformly dark brown.

Front flat or slightly concave; sharply declivous; anterior margin broadly rounded; punctation rather coarse, even. Antennæ short, attaining about the basal margin of the prothorax; joint 3 slightly longer than 2, the two together about as long as 4; eleventh simple.

Prothorax moderately convex, with sides rather precipitous, as long as wide; punctation simple, even, fairly coarse, but finer on basal declivity; sides narrowing on anterior half, nearly parallel on basal half with posterior angles in the general outline, but incurving at their tips; posterior angles with a sharp carina; basal sulci very short. Scutellum shield-shaped, pointed behind; flat to slightly concave.

Elytra behind the humeri a little wider than the prothorax; sides parallel to about the middle, thence conjointly narrowed to the rounded apex; striæ shallowly impressed with punctures shallow and fairly coarse; intervals feebly convex, finely punctulate.

Described from a holotype male, Tulagi, Solomon Islands, *R. A. Lever*, April 1933, and from a paratype (probable) male from Su'u, Malaita, British Solomons, *R. J. A. W. Lever*, April 1933. The holotype is in the British Museum, the paratype in the type-collection of the Hawaiian Entomological Society.

This species differs from the Fijian *P. major* (Candèze) and from all the known Polynesian species in having the 3rd antennal joint subequal in length to the 2nd, instead of nearly or quite the length of the 4th.

The paratype has the pubescence definitely grey instead of brownish, and has the posterior angles of the prothorax reddish instead of dark brown. It is the smaller of the two specimens, and, although the ædeagus is not protruded, the general proportions of the insect are those of the specimen known to be a male.

Correction.—In 'Stylops,' vol. ii. pt. 8, p. 183, August 1933, the following incorrect locality citation appears :— " . . . . *Simodactylus acutus* in the Solomons . . ." So far as known, this species occurs only on Taveuni of the Fiji group.

XXV.—*Reptiles and Amphibians from Southern Ecuador.*

By H. W. Parker, B.A., Department of Zoology, British Museum (Natural History).

The British Museum is once again indebted to Prof. Clodoveo Carrión for a fine series of reptiles and amphibians from the province of Loja. In addition to representatives of two species which do not appear to have been previously described, there are examples of several others hitherto known only from single specimens or limited series, and others, again, which add materially to our knowledge of the geographical distribution of the species they represent. The collections were made in three localities, not widely separated but at very different altitudes, and, since our knowledge of the vertical distribution of reptiles and amphibians in the Andes is so meagre, it has been considered worth while to give a complete list of all the species collected at each station; but any attempt to generalize on the subject would, at present, be decidedly premature. The altitudes of the different localities are :—Loja City, S.E. Ecuador, 7200 ft.; Zamora, 50 kilometres east of Loja, 3250 ft.; 5 kilometres east of Loja, 9200 ft.

AMPHIBIA.

GYMNOPHIONA.

Cœcilia pachynema Günther.

1 ad., Zamora, 3250 ft.

The presence or absence of dermal scales is a character on which considerable stress is usually placed, and, as a rule, all species of the same genus agree in possessing or lacking them. But *C. pachynema* appears to afford a connecting-link between the genera *Cœcilia* and *Siphonops*, for dermal scales and their associated secondary folds may be present or absent, and the number of teeth in the inner mandibular row is greatly reduced. In all other species, so far as is known, there is absolute correlation between the presence of dermal scales and secondary dermal folds; but the following table shows how completely the correlation breaks down in the present species :—

Locality.	Secondary folds.	Scales.
W. Ecuador	Nil.	Nil (type).
Intac, Ecuador	,,	,, (type of *C. buckleyi*).
Zamora	,,	,,
Milligalli	,,	Present.
Intac, Ecuador	,,	,,
Guayaquil	8	,,

? *Rhinatrema bicolor* Boulenger.

Larva, Zamora, 3250 ft.

This specimen measures 145 mm., of which 9 belong to the tail, which is compressed and obtusely pointed. The eyes are large and there is no tentacle; a row of muciferous crypts extends from beneath the eye to below the nostril, and another, less well marked, from above the eye to the tip of the snout. Three pairs of small external gills are persistent, the two anterior pairs fimbriated, with five or six finger-like processes, and the last reduced to a mere knob; ventral to this last is a single oblique slit-like gill-cleft equipped with a large valvular flap on each side and lying in a circular depression. The colour is dark brown, uniformly stippled with yellowish above and beneath; a broad V-shaped light band borders the lower jaw.

There are numerous secondary dermal folds, mostly complete, and dermal scales; the eye is visible, and there is a well-developed inner row of mandibular teeth; the dermal folds number about 270, of which nearly half are secondary. This combination of characters is found amongst Ecuadorian cœcilians only in *Rhinatrema bicolor*, but precise identification of a larva is impossible in the present state of our knowledge.

SALIENTIA.

Bufo spinulosus Wiegmann.

♀, Loja, 7200 ft.

Bufo typhonius (Linn.).

Hgr. ♂, Zamora, 3250 ft.

Bufo cœruleostictus Günther.

2 juvs., Zamora, 3250 ft.

Telmatobius niger Barbour & Noble.

♀, Loja, 7200 ft.

The rediscovery of this species, hitherto known only from the type series, close to Loja City lends additional support to the suggestion put forward by the original describers that the type-locality, "Palmira Desert," is in reality the hacienda Palmira in the province of Loja. The present specimen differs from the description of the types in having the black of the upper surfaces uniformly and regularly beset with small greenish-yellow vermiculations and in being somewhat larger; it measures 80 mm. from snout to vent.

Lithodytes lineatus (Schneider).

2 ♀♀, Zamora, 3250 ft.

Leptodactylus caligнosus Girard.

♂, ♀, Zamora, 3250 ft.

The name is here used in its wide sense. Lutz has recently shown that the widely distributed *calignosus* of most authors is subdivisible into a number of forms; but sufficient comparative material is not available to the present writer to enable him to determine the status of the one occurring in the Andes of western Ecuador.

Eleutherodactylus carrioni Parker.

6 ♂♂, ♀♀, Loja, 7200 ft.
6 ♂♂, ♀♀, hgr. & yg., Zamora, 3250 ft.

Eleutherodactylus latidiscus (Boulenger).

♀, Zamora, 3250 ft.

? *Eleutherodactylus bisignatus* (Werner).

♂, Zamora, 3250 ft.

This example and two others in the British Museum from Guatea, 2900 ft., W. Ecuador, agree with the original description of *bisignatus* in most points, notably in the absence of digital webbing, the position of the nostril once and a half as far from the eye as from the tip of the snout, the yellow stripe along the upper lip, the white-spotted thighs, and the brown-flecked throat and chest; but they lack the sigmoid markings which prompted the name. In addition, they also differ from *gollmeri* (of which *bisignatus* was believed to be a race) in the possession of a first finger extending beyond the second and a slightly larger tympanum. These two differences are sufficiently well marked to make it seem probable that the specimens from western Ecuador are specifically distinct from *gollmeri*, and that consequently, if the present allocation of Werner's name is correct, *bisignatus* should receive specific status.

Centrolene pulveratum Peters.

♀, Zamora, 3250 ft.

Hyla rhodopepla Günther.

♀, Zamora, 3250 ft.

No specimens of this species appear to have been reported since 1858, when it was described from a single supposedly half-grown example. The new one agrees admirably with the type in morphological characters, colour, and size ; but it is a fully adult, breeding female.

Hyla calcarata Troschel.

♀, Zamora, 3250 ft.

Gastrotheca marsupiata lojana Parker.

27 ♂, ♀, hgr., & yg., Loja, 7200 ft.
♂, Zamora, 3250 ft.

Phyllobates pulchellus Espada.

♀, Zamora, 3250 ft.

Atelopus ignescens (Corn.).

2 ♂♂, 6 ♀♀, Loja, 7200 ft.
4 ♀♀, 1 juv., Zamora, 3250 ft.

These two series differ markedly in their coloration. The examples from Loja are uniform saffron-yellow above and beneath, whereas four of those from Zamora are jet-black above and yellow beneath, with the black of the upper surfaces invading the anal region and the soles of the feet; the three inner toes and the outer metatarsal tubercle are constantly yellow. A transitional stage between these two contrasting colourings is provided by the remaining Zamora specimen, in which the amount of black pigment is much less, though its distribution is the same. As a consequence the upper surfaces, anal region, and sole of the foot are a pale yellowish olive instead of jet-black, and it is easy to see how a further increase or reduction of the black pigment, operating on a yellow-pigmented background, could produce two such marked colour varieties.

REPTILIA.

LACERTILIA.

Anolis fusco-auratus d'Orbigny.

♀, Zamora, 3250 ft.

Anolis ortoni Cope.

♀, Zamora, 3250 ft.

Enyalioides præstabilis O'Shaughnessy.

♂, Zamora, 3250 ft.

Leiocephalus ornatus ornatus (Gray).

Hgr., 2 juvs., Loja, 7200 ft.

Stenocercus carrioni, sp. n.

Holotype a ♂, number 1933.6.24.75 in the British Museum, from Zamora, 3250 ft., Ecuador.

No pterygoid teeth. One or two conical scales, forming a feeble denticulation on the anterior border of the ear;

supraocular scales enlarged in the middle, broader than long; no enlarged occipital. Sides of the neck irregularly plicate; a transverse fold in front of the collar, which is widely interrupted in the middle and continuous laterally with a strong antehumeral fold. Body depressed. A row of slightly enlarged scales forms a feeble crest on the neck and anterior part of the back. Nuchal and lateral scales small, smooth, conical; dorsal scales keeled, small anteriorly, but increasing rapidly caudad, and gradually merging into the very large caudal scales; keels forming lines convergent towards the mid-line of the back. Ventral scales smaller than the posterior dorsals, arranged in regular transverse series. Scales around the middle of the body about 85; 11 transverse rows of ventrals correspond to a linear series of 10 mid-dorsal scales on the middle of the back. Dorsal caudal scales strongly mucronate, spinose, arranged in regular whorls which are alternately larger and smaller; inferior caudals keeled but not spinose. The fourth toe of the adpressed hind limb reaches midway between the fore limb and the tympanum; second toe extending well beyond the outer.

Greenish brown above, with irregular, indistinct, black blotches and some lighter dots; on the posterior half of the back the black markings form an indistinct median zigzag stripe; flanks olive, with small light spots, tail with a median series of black spots; a light streak from beneath the eye to the sides of the neck. Lower surfaces uniform greenish olive.

Length from snout to vent 71 mm.; tail (regenerated posteriorly) 80 mm.; fore limb 28 mm.; hind limb 41 mm.

This species is most closely allied to *S. simonsi* Boulenger and *S. atrigularis* Werner; it is a member of that section of the genus which is characterized by spinose caudal scales arranged in regular whorls, and its position may be expressed in key-form thus:—

I. Caudal whorls subequal.
  (*a*) Ventral and dorsal scales subequal, with the laterals not markedly smaller than either; scales around the middle of the body about 50 .... *S. marmoratus* (Dum. & [Bibr.).
  (*b*) Lateral scales granular, much smaller than either the dorsals or ventrals;

scales around the middle of the body about 120 .... *S. crassicaudatus* [Tschudi.
(*c*) Lateral scales granular, smaller than either the dorsals or ventrals; scales around the middle of the body about 85. *S. simonsi* Boulenger.
II. Caudal whorls alternately larger and smaller, the latter about ½ to ⅔ the length of the former.
(*a*) Ventral scales very small; lateral scales keeled; no pterygoid teeth .... *S. atrigularis* Werner.
(*b*) Ventral scales moderate, arranged in transverse series; lateral scales smooth; no pterygoid teeth; about 85 scales round the middle of the body .... *S. carrioni*, sp. n.
(*c*) Ventral scales large, arranged quincuncially; lateral scales smooth; pterygoid teeth present; about 65 scales round the middle of the body ...... *S. roseiventris* [(d'Orbigny).

Macropholidus annectens Parker.

♂, juv., Zamora, 3250 ft.

Pantodactylus buckleyi festæ Peracca.

♂, 2 ♀♀, Zamora, 3250 ft.

These three examples show some variation beyond that previously recorded for the subspecies, notably a higher number of femoral pores (8+9) and a marked sexual dichromatism. In females the ventral surfaces are uniform yellow or white except for a black smudge on the preanal plates and some dark blotchings on the posterior half of the tail. In the male, however, each scale, except the chin-shields, has a large black spot, only the posterior free margin being white, so that the whole of the lower surface appears black, with transverse rows of narrow white spots.

Pholidobolus montium Peters.

♂ & hgr., Zamora, 3250 ft.

This genus is usually said to lack femoral pores, but the series of this species in the British Museum shows that they are really present, though small, in the male sex; from three to five may be found on each side.

Prionodactylus vertebralis O'Shaughnessy.

2 ♂♂, 2 ♀♀, 2 juvs., Zamora, 3250 ft.

Amphisbæna fuliginosa Linn.

1 ad., Zamora, 3250 ft.

Mabuya agilis (Raddi).

2 ads., Zamora, 3250 ft.

SERPENTES.

Atractus carrioni Parker.

4 ♂♂ (v. 144, 147, 143, 146; c. 26+*n*, 30+1, 31+1, 32+1); ♀ (v. 153; c. 23+1), Loja, 7200 ft.

This series shows some variation in the vestigial preoculars beyond that already recorded. One male has a small preocular on one side at the antero-dorsal corner of the eye, whereas the female has a small scale present on both sides at the antero-ventral corner. In addition, the prefrontal may reach the first upper labial and there may be only three pairs of labials in contact with the chin-shields.

Atractus major Boulenger.

♂ (v. 161; c. 42+1); ♀ (v. 169; c. 34+1), 5 kilom. E. of Loja, 9200 ft.

♂ (v. 156; c. 40+1), Zamora, 3250 ft.

Chironius carinatus (Linn.).

Juv. (v. 145; c. 116+1), 5 kilom. E. of Loja, 9200 ft.

Xenodon severus (Linn.).

3 juvs. (v. 140, 141, 137; c. 40+1, 36+1, 42+1), Zamora, 3250 ft.

Dipsas mikanii oreas (Cope).

2 ♀♀ (v. 177, 180; c. 77+1, 76+1), Loja, 7200 ft.

The first-mentioned of these examples possesses two small præoculars, one above and one below the loreal.

Dipsas palmeri (Boulenger).

Juv. ♂ (v. 198; c. 114+1), Zamora, 3250 ft.

This example agrees well in essentials of pholidosis and colour with the single example hitherto recorded, the holotype, but some minor differences are apparent. There are, on one side, only eight upper labials, of which the fourth and fifth enter the eye, and the second pair of lower labials very nearly make contact in front of the chin-shields. The colour-pattern is more sharply defined and the anterior annuli are broken ventrally; down the centre of the belly is a black line, rather indistinct posteriorly and broken up anteriorly into a series of elongate spots which alternate with the dorsal annuli.

Pseudoboa clœlia (Daudin).

Juv. (v. 214 ; c. 84+1), 5 kilom. E. of Loja, 9200 ft.

Pseudoboa petola (Linn.).

Juv. (v. 216 ; c. 113+1), 5 kilom. E. of Loja, 9200 ft.
♂ (v. 206 ; c. 96+*n*), Zamora, 3250 ft.

Bothrops castelnaudi Dum. & Bibr.

♀ (sc. 25 ; v. 244 ; c. 80+1), Zamora, 3250 ft.

Bothrops lojana Parker.

♂ (sc. 23 ; v. 145 ; c. 45+1), juv. (sc. 21 ; v. 149 ; c. 38+1), Loja, 7200 ft.

In the juvenile specimen a few scattered subcaudals are single.

Bothrops alticola, sp. n.

Holotype a male, number 1933.6.24.115 in the British Museum, from 5 kilom. east of Loja, Ecuador (9200 ft.).

Snout twice as long as the orbit, with rectangular canthus rostralis. Rostral slightly broader than deep ; nasal semidivided ; upper head-scales strongly keeled and imbricate, largest on the upper surface of the snout ; five series of scales between the supraoculars, which are large and rugose ; internasals large, in contact behind the rostral and separated from the supraoculars by two scales ; two granular postoculars and a very long narrow subocular in contact with the second and third labials ; seven upper labials, the second forming the anterior border of the loreal pit. Scales with long keels, in 19 rows. Ventrals 178 ; anal entire ; subcaudals 63+*n* where *n* is small, the first 20 single, the remainder divided. Tail prehensile. Greenish yellow above, with a series of transverse black spots which form regular bars on the middle of the body, but elsewhere are rather indefinite ; each spot is faintly light-margined, and appears lighter in the middle on account of the presence of a yellow shaft along the keel of each scale ; interspaces between the bars and spots with a dusky shading, and similar yellow shafts on the keels ; a diagonal black stripe from behind the eye to the angle of the mouth, and a parallel stripe on the occiput from above each supraocular. Lower surfaces yellow, uniform anteriorly, but with black mottlings increasing in amount posteriorly. Terminal fifth of the tail white (red in life ?).

Length from snout to vent 552 mm.; tail (incomplete) 107 mm.

This viper of the high Andes is related to the other Andean species, *peruvianus*, *oligolepis* *, and *medusa*, and to the Central American *nigroviridis*. From the first three it is distinguished by the lower number of mid-body scale-rows, as well as by other characters of pholidosis and colour-pattern; from *nigroviridis* (including its subspecies *marchi* and *aurifer*) it is recognizable by the presence of enlarged internasals, a longer snout, fewer upper labials, more numerous ventrals, and colour.

XXVI.—Airtonia, *a new Brachiopod Genus from the Lower Carboniferous of Yorkshire, with Notes on Replacement of Shell Substance by Quartz.* By F. Wolverson Cope, M.Sc., F.G.S., H.M. Geological Survey.

[Plate VI.]

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IX. Note on the Silicification 286

I. Introduction.

The material used in the study of this new brachiopod was obtained from the vicinity of Airton Green, near Settle, Yorkshire. A portion of it was lent to me by Dr. R. G. S. Hudson, whilst the remainder, including the holotype, was collected by myself at a subsequent date.

* Werner (Archiv f. Naturg. lxxxviii. A, 8, p. 235, 1922) places his *Lachesis bilineatus* var. *oligolepis* as a synonym of *L. chloromelas* Boulenger; but *oligolepis* has eleven years' priority over Boulenger's name.

II. NATURE OF MATERIAL AND METHOD OF INVESTIGATION.

The brachiopods are more or less completely silicified, and occur in a matrix of compact, partially dolomitized limestone. Each specimen was, as far as possible, stripped of superfluous matrix and then immersed in a bath of hydrochloric acid (a 75 per cent. solution was found to be most satisfactory). The specimen was thus cleaned internally as well as externally, and the internal structures were clearly revealed. Delicate markings such as muscle-impressions were varnished over as soon as the matrix adhering to them had been dissolved away; this precaution was necessary, as a thin section of one of the valves showed that the silicification was incomplete, some fragments of calcite remaining, the solution of which would result in a pitting of the surface and a possible destruction of fine markings. When the valves had been dissolved out of the matrix in this way, they were immersed in a solution of ammonium hydroxide in order to neutralize any acid present in the interstices, and finally they were washed in running water, dried carefully, and painted with a solution of celluloid in amyl acetate. By this method, a large number of valves showing internal and external characters was obtained.

III. THE GENUS *AIRTONIA*.

For the reception of the new brachiopod, I propose to erect the genus *Airtonia*, the diagnostic characters of which have been based upon an examination of the holotype described in detail below, and upon the paratypes shown in figs. 6–10.

AIRTONIA, gen. nov.

Diagnosis.—Shell unattached, concavo-convex dorsoventrally. Pedicle valve with cardinal area more or less developed, prominent umbo and hinge-teeth; visceral cavity deep, occupied by one pair of elongate adductor muscle-impressions more or less enclosed by flabellate divaricator muscle-impressions. Brachial valve concave with well-developed and strongly projecting quadrifid cardinal process; a pair of slightly divergent forked ridges extends from the base of the cardinal process.

A pair of small brachial scars occur at the anterior end of the forked ridges. Adductor muscle-impressions occupying angles between the forked ridges and the hinge-line. Brachial ridges curved, hook-shaped.

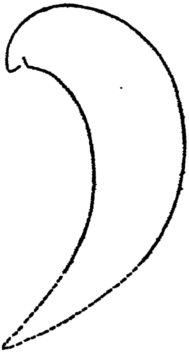
External ornament on both valves of fine uniform costæ; intervening sulci occupied by numerous perforations. Small spines present on edge of ventral cardinal area.

Genotype: *Airtonia hudsoni*, sp. n.

IV. *AIRTONIA HUDSONI*, GEN. ET SP. N.

Holotype *.—Pedicle and brachial valve deposited in the Collection of the British Museum (Natural History), B 86710.

Text-fig. 1.



Airtonia hudsoni, gen. et sp. n. Holotype, B.M. B 86710. Natural size.

Profile of pedicle and brachial valves.

Locality.—South-east Quarry, Airton Green, near Settle, Yorkshire.

Horizon.—Lower Airton Limestone †, Lower Carboniferous, C_2 sub-zone.

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* Paratypes are in the British Museum (Natural History) and are referred to by their Register numbers (B.M. B 86711 etc.), and in the Museum of Practical Geology, referred to similarly by M.P.G. 57250 etc.

† The Lower Airton Limestone is considered by Dr. R. G. S. Hudson to be equivalent in the main to the Upper Clitheroe Limestone of the Geological Survey (1). Dr. Hudson's work upon the stratigraphy of the Malham-Airton area is as yet unpublished.

The specimen selected as the holotype is complete, except at the anterior edges of the valves. The longitudinal profile shown in text-fig. 1 was observed and plotted after partial removal of the limestone matrix. The portions indicated by the discontinuous lines were lost owing to incomplete silicification in those parts.

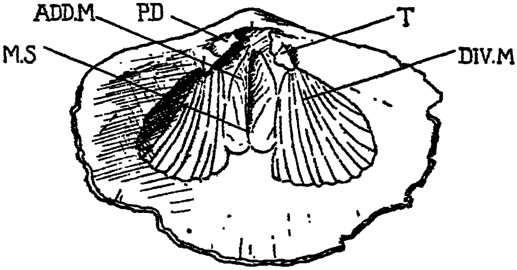
Description of Holotype.

1. PEDICLE VALVE. (a) *External Characters.*—This valve is rounded-quadrate in outline with a maximum length of about 48 mm. (estimated), a width of 46 mm., and a maximum thickness of about 26 mm. or a ratio of 1 : 1 : 0·5 ; the greatest width is just anterior to the hinge-line. The valve is strongly convex (fig. 1) with steep cardinal slopes and lateral flanks, the cardinal slopes flattening slightly to the sub-angular aural extremities, whilst the umbo is well marked, projects somewhat beyond the hinge-line, and is incurved at the apex. The umbonal angle is about 120°. The venter is slightly arched for the first centimetre measured from the apex of the umbo, but it broadens rapidly, becomes more gently curved, and flattens anteriorly. The hinge-line is straight in the central region, but curves slightly upon approaching the extremities.

The surface of the valve is ornamented with fine uniform costæ, which become slightly coarser towards the anterior edge of the valve ; these costæ are separated by sharp sulci which include numerous perforations (see Section VI., p. 280). Increase in the number of costæ takes place by the intercalation of new costæ and also by the bifurcation of previously existing ones. At 20 mm. from the apex of the umbo, there are about 25 costæ in 10 mm. measured across the venter.

(b) *Internal Characters.*—The hinge-line is bounded by a low and somewhat indefinite cardinal area, which runs anteriorly into a flat shelf, covered when the brachial valve is in position. The maximum width of the shelf (inclusive of the cardinal area) is about 5 mm. Laterally, this shelf runs smoothly into the rounded aural extremities, but below the incurved tip of the umbo it is broken by a more or less triangular delthyrial opening about 5 mm. in height and with a base width of about 10 mm. This opening is bounded laterally by strong lamellæ inclined dorsally to the median line. These lamellæ are divided transversely by a shallow groove ; the anterior portions of the lamellæ form stout teeth for the articulation of the brachial valve, whilst the posterior portions appear to represent a somewhat broken pseudodeltidium. Each lamella is marked off from the flattened shelf previously mentioned by an angular depression. On the central region of the valve, the flat shelf projects over the deep, transversely oval, visceral cavity. The visceral cavity measures about 30 mm. along the greater axis and about 18 mm. along the lesser axis. Immediately below the delthyrial opening is a small cavity, the delthyrial cavity, leading anteriorly into the visceral cavity.

Text-fig. 2.



Airtonia hudsoni, gen. et sp. n. Holotype.
Interior of pedicle valve. Natural size.

ADD.M., adductor muscle impression; *DIV.M.*, divaricator muscle impression; *M.S.*, median septum; *P.D.*, portion of broken pseudodeltidium; *T.*, tooth.

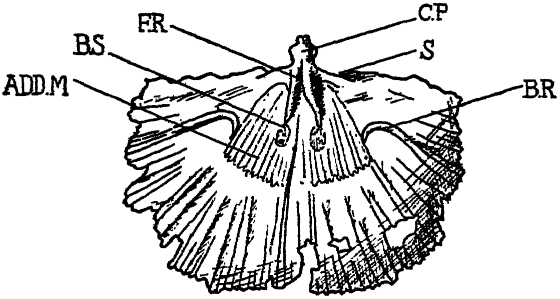
The descent from the former to the latter is steep. Buttressing the base of the delthyrial cavity anteriorly, and dividing the visceral cavity at its posterior end, is a short thin well-developed median septum, which along most of its length also divides a low flat platform about 5 mm. wide, and running the whole length of the visceral cavity. Posteriorly the outer edges of this platform supply feeble buttresses to the base of the delthyrial cavity. Upon the platform on either side of the median septum is the single narrow elongate obliquely-striated adductor muscle-impression (text-fig. 2, and Pl. VI. fig. 4). On each side of the adductor platform, and filling the remainder of the visceral cavity, is the large flabellate longitudinally-striated divaricator muscle-impression.

In the region of the adductor platform, the pedicle valve shows a maximum thickness of about 6 mm., but anterior to the visceral cavity the shell thins rapidly.

The interior of the valve beyond the visceral cavity is marked with numerous, radially arranged, low, elongate pustules or papillæ.

2. Brachial Valve. (a) *External Characters.*—This valve is uniformly concave (text-fig. 1) with a straight hinge-line dominated by a well-developed projecting cardinal process (text-fig. 3 and Pl. VI. figs. 5 & 6). The ornamentation is similar to that of the pedicle valve; in the middle of the valve at 20 mm. from the base of the cardinal process there are about 23 costæ in 10 mm.

Text-fig. 3.

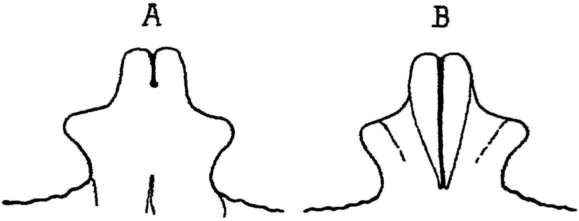


Airtonia hudsoni, gen. et sp. n. Holotype. Interior of brachial valve. Natural size.

ADD.M., adductor muscle impression; *B.R.*, brachial ridge; *B.S.*, brachial scar; *C.P.*, cardinal process; *F.R.*, forked ridges; *S.*, dental socket.

(b) *Internal Characters.*—The valve is comparatively thin and the inner surface follows the outer surface in contour. The cardinal process stands up above the hinge-line (text-fig. 3)—apparently there is no cardinal area—and is divided by a deep and narrow groove which runs the whole length of its dorsal surface and a small distance down its ventral surface. Each half is again divided as shown in text-fig. 4. On either side of the base of the cardinal process are the groove-like dental sockets for the reception of the hinge-teeth of the pedicle valve, and these are supported anteriorly by short obliquely-directed ridges on the inner surface of the valve. Running from the base of the cardinal process are two stout upstanding ridges (the forked ridges), which diverge from one another at an angle of about 10° and which, at a distance of about 8 mm. from the base of the cardinal process, become separate from the surface of the valve. They end abruptly * as shown in text-fig. 3. Occupying the angles between the forked ridges and the supporting ridges to the dental sockets are the flabellate adductor muscle-impressions extending antero-laterally as indicated. Situated below the ends of the forked ridges on slight eminences are two small striated scars (brachial scars) probably connected with the brachial system. In each half of the valve, a well-marked brachial ridge commences on the lateral margin and runs in the direction of the cardinal process, at a distance of about 12 mm. from which it suddenly curves anteriorly towards the middle line and ends abruptly against the adductor muscle impressions.

Text-fig. 4.



Cardinal process of *Airtonia hudsoni*. Holotype, × 5.

A. Inner or ventral aspect.
B. Outer or dorsal aspect.

At a distance of about 15 mm. from the base of the cardinal process, rounded radially-directed ridges appear on the inner surface of the brachial valve; these deepen into vertical lamellæ when traced towards the margin, especially at the anterior edge of the valve. One of these lamellæ in the median line runs as a low ridge into the angle between the forked ridges.

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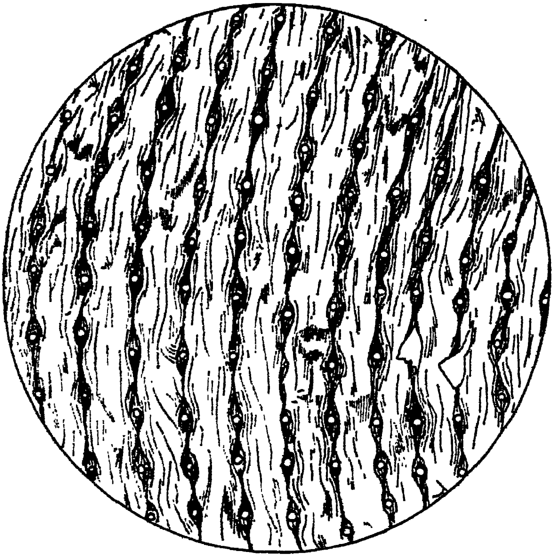
* In the holotype the fine points of the forked ridges are fractured, and the possibility of their further extension in the original state was investigated. Another specimen almost identical with the holotype, and which had not been treated with acid, was sliced transversely commencing at the umbo. These sections revealed that the forked ridges terminate abruptly at a distance of about 10 mm. from the base of the cardinal process.

V. DISTRIBUTION OF *AIRTONIA HUDSONI*.

As yet, the brachiopod is known only from the Lower Airton Limestone (C_2 sub-zone) of Airton Green, Kirk Gait Hill, and Scosthrop Lane in the Settle area of Yorkshire. Dr. Hudson informs me that he has not found it elsewhere in the Craven Lowlands.

Airtonia hudsoni appears to be a member of a facies fauna; thus it is found in the Airton Limestone, but it is unknown in the overlying Reef Limestones of the Airton Reef Belt.

Text-fig. 5.



Tangential section (B.M. B 82176) of external silicified layer of pedicle valve of holotype of *Airtonia hudsoni*, gen. et sp. n., showing perforations between the costæ. Diameter of field=4·3 mm.

VI. NOTE ON THE SHELL STRUCTURE OF *AIRTONIA HUDSONI*.

A longitudinal section of an uncleaned specimen shows that the calcite is, for the most part, laid down in oblique lamellae as described by Delépine (2) in the case of

Daviesiella llangollensis (Dav.). In the gerontic stages of *Airtonia hudsoni*, some resorption of these oblique lamellæ appears to take place, followed by the deposition of lamellæ which follow the curvature of the inner surface of the valve. This is the case more particularly in the visceral region of the brachiopod.

A thin tangential section (text-fig. 5) of a fragment of the pedicle valve of the holotype of *Airtonia hudsoni* shows costæ separated by narrow sulci in which are numerous perforations arranged fairly regularly. The diameter of the field in the text-figure is 4·3 mm., so that this portion of the valve showed approximately 26 costæ per centimetre. The perforations, the function of which is controversial, are on the average about 0·4 mm. apart. Further sections suggest that these perforations become closed on the surfaces of the valves. It is probable that they were functional on the mantle edge only.

VII. VARIABLE AND CONSTANT CHARACTERS IN THE SPECIES.

By the method of development outlined in a previous section, a large number of specimens of *Airtonia hudsoni* showing internal as well as external characters was obtained. These, including the holotype, can be arranged in several continuous-variation series for a number of variable characters. As will be seen below, the variation is considerable, and, but for the presence of intermediate members, it is doubtful whether the extreme variants would have been recognized as co-specific with the holotype.

It is to be noted that the pedicle valves vary considerably in general appearance (text-figs. 2 & 6–10 *), and this variation is the main thesis of this section. The brachial valves, however (unfortunately, owing to their more fragile nature not more than four brachial valves showing internal structure could be obtained), are remarkably constant in all their characters ; the only slight variation noticed was in the elevation of the brachial scars on small eminences, the height of such eminences probably varying with the age of the individual. In the gerontic stages, when the valves (especially the pedicle valves) become somewhat thickened, the muscles would of

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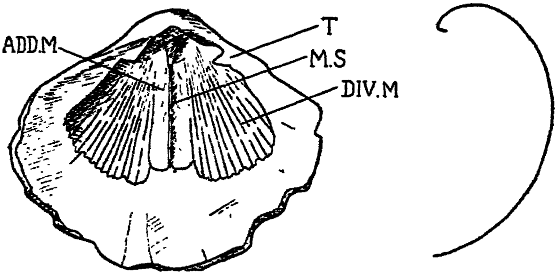
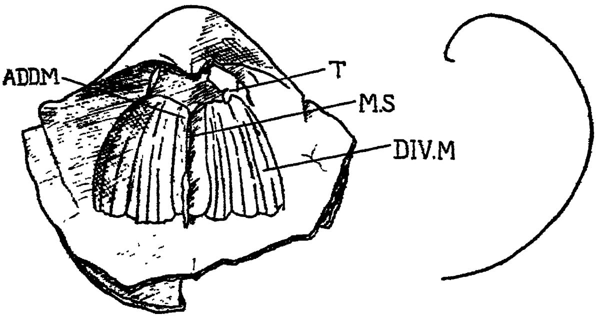
* The lettering used in text-figs. 6–10 is the same as in text-fig. 2.

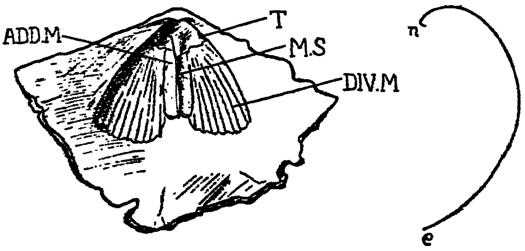
Text-fig. 6.



Text-fig. 7.



Text-fig. 8.



Airtonia hudsoni, gen. et sp. n. Natural size.

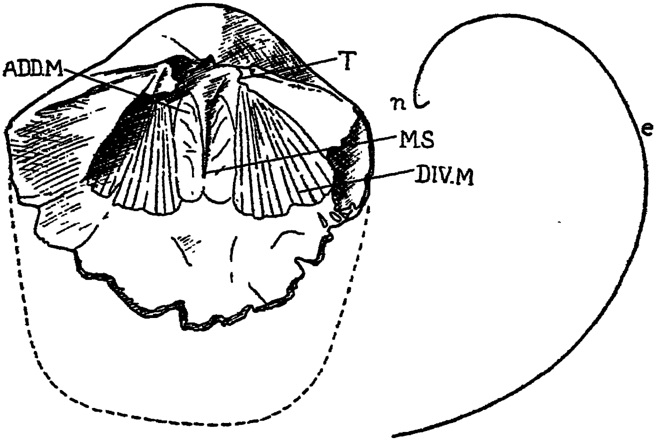
Fig. 6.—Paratype. M.P.G. 57249. Lower Airton Limestone, Scosthrop Lane, near Settle, Yorkshire.

Fig. 7.—Paratype, M.P.G. 57250. Lower Airton Limestone, Northwest Quarry, Airton Green, Yorkshire.

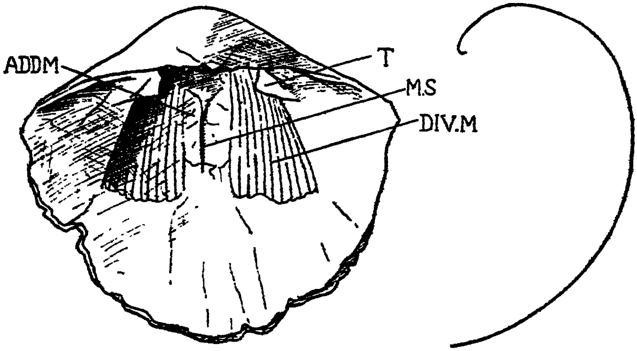
Fig. 8.—Paratype, M.P.G. 57247. Lower Airton Limestone, Northwest Quarry, Airton Green, Yorkshire. [*Note.*—The profile *ne* of the young form shown in this figure corresponds accurately with the early portion *ne* of the complete profile of the gerontic individual shown in text-fig. 9.]

necessity be enlarged to some extent, and an increase in the area of their attachment was probably brought about by differential deposition and perhaps also by a certain amount of resorption. The characters of the brachial valve (being so constant) are therefore of the utmost value in a diagnosis of the species.

Text-fig. 9.



Text-fig. 10.



Airtonia hudsoni, gen. et sp. n. Natural size.

Fig. 9.—Paratype, B.M. B 86711. Lower Airton Limestone, South-east Quarry, Airton Green, Yorkshire.

Fig. 10.—Paratype, B.M. B 86713. Lower Airton Limestone, South-east Quarry, Airton Green, Yorkshire.

1. *Constant Characters.*—In the pedicle valves there are but two constant characters :—

(a) *The Profile or Curvature of the Venter.*—For the pedicle valve of the holotype, this is shown in text-fig. 1, whilst in text-figs. 6–10 the profile is shown alongside the drawing of the valve. These profiles were accurately delineated by tracing the image formed on the focussing-screen of an enlarging camera. At first sight, the profiles shown in the figures may not appear to be constant, but it is to be remembered that the specimens are of different ages as attested by both the size and thickness of the valve. For example, text-fig. 8 is that of a young individual, whilst text-fig. 9 is that of a gerontic individual. By means of a tracing, however, it is seen that the profile in text-fig. 8 corresponds accurately with the portion *ne* of the profile shown in text-fig. 9. Similarly, the profiles of all the specimens have been shown to be identical.

(NOTE.—Text-fig. 9 is a drawing of the oldest individual in the collection, and it shows a tendency towards the development of a trail, as is commonly the case in some of the productids. The greater portion of the trail in this specimen was lost, however, during the solution of the matrix filling the valve.)

(b) *The Ornament.*—This consists invariably of fine uniform costæ separated from one another by narrow sulci. The number of costæ per unit width of the valve at a given distance from the umbo is practically constant, *e. g.*, the number of costæ in 10 mm. at 20 mm. from the umbo is always 23–26.

2. *Variable Characters of the Pedicle Valve* :—

(a) *Shape.*—The curvature of the venter has been shown to be constant. There is some slight variation in the development of the auricular extremities, but they are always rounded, and externally the cardinal flanks are steep. Text-figs. 6–10 may suggest variable incurving of the umbo, but this is due to the fact that, owing to the different ages of the individuals, slightly different positions of the valves have had to be adopted in order to exhibit the interiors satisfactorily. Thus, had the valve of text-fig. 10 been held in the same position as that of the valve in text-fig. 8, the amount of the external surface shown at the posterior ends would have been the same, but, owing to its greater age and consequently more complete valve, the muscle impressions in text-fig. 10 would have been partially obscured by the somewhat foreshortened anterior portion of the valve.

(b) *Muscle Impressions.*—Some idea of the variation in size and shape of the impressions can be obtained from the text-figures. The shape of the visceral cavity appears to vary very slightly in individuals of approximately the same age, but a great deal of the variation shown is due almost certainly to age-differences of the specimens.

(c) *Septum.*—This may vary from a fairly well-developed median septum to only an apical callosity, and accordingly, in these brachiopods at least, the septum, which was deposited within an infold of the mantle, does not appear to be of any classificatory importance.

(d) *Teeth.*—These are usually well developed and vary in their distance apart, a variation which is doubtless due to age-differences between the specimens.

A gerontic individual shows a thickened pedicle valve (occasionally as thick as 10 mm. in the central region), may exhibit a tendency towards the development of a trail, has deepened muscle impressions with strongly marked striations, and has prominent teeth which are more widely separated than in younger individuals.

VIII. SYSTEMATIC POSITION OF *AIRTONIA*.

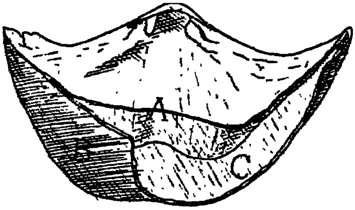
In the presence of a ventral cardinal area, pseudodeltidium, teeth, and a cardinal process which fills up almost the whole of the delthyrial opening, as well as in the general shell structure and arrangement of the muscle impressions, *Airtonia* seems to have affinities with *Chonetes* Fischer v. Waldheim. Apart from the muscle impressions, the brachial valve of *Airtonia* is very different from that of *Chonetes*, s. str., as exemplified by *Chonetes striatella* (Dalman). The thick pedicle valve in the gerontic stages of *Airtonia* suggests a comparison with *Daviesiella* Waagen [referred to as a subgenus of *Chonetes*, sensu lato, by Paeckelmann (3)]. From *Daviesiella*, *Airtonia* differs in the presence of only one pair of adductor muscle impressions in the pedicle valve, whilst in the brachial valve, brachial and forked ridges are invariably present in *Airtonia*, but are absent in *Daviesiella*.

Airtonia, as a genus, is to be grouped in the subfamily Chonetinæ Waagen, 1884, emend. Schuchert 1897, but its relations with *Chonetes* Fischer v. Waldheim, sensu stricto, and with *Daviesiella* can only be determined by a systematic study of the Chonetinæ as a whole, an investigation which is at present receiving my attention.

IX. Note on the Silicification.

The worker on Carboniferous brachiopods is rarely favoured with material so suited to the application of simple palæontological technique as that from Airton Green. The brachiopods are so silicified that, by using the method previously outlined, they may be separated from the limestone matrix to show internal as well as external structures. In the case of the brachial valves, silica has replaced practically the whole of the original calcareous shell substance, but in the case of the pedicle valves silicification has taken place only in the outermost and innermost layers of the shell substance. As a result of this, treatment with acid of a pedicle valve gives a hollow shell as shown in text-fig. 11. The process of silicification has been selective, and brachial and pedicle valves are not fused together along the hinge-line; after treatment with acid, the brachial valve is found hinged on to the teeth of the pedicle valve, and so the two are readily separated.

Text-fig. 11.



Pedicle valve of *Airtonia hudsoni*, gen. et sp. n., viewed from anterior end. Natural size. The valve has been treated with acid, so that only the silicified portion remains.

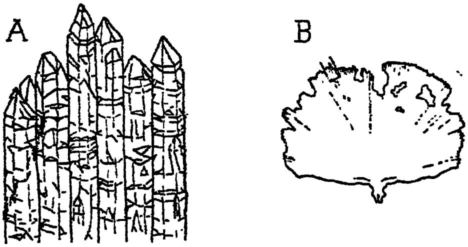
A, internal silicified layer; B, external silicified layer; C, cavity between silicified layers occupied by calcareous shell substance before treatment with acid. [N.B.—A portion of the external silicified layer has been cut away.]

When the actual replacement is examined, it appears remarkable that features such as fine costæ with perforations in the intervening sulci are still clearly observable.

The silica is present in the form of small quartz crystals. They frequently display crystal faces on the external surfaces of the valves. In the visceral region of both valves the quartz crystals are extremely small and closely compacted, so that the muscle scars appear with a surface of homogeneous texture and show fine striations accurately. Invariably, the quartz crystals on the external surfaces lie with their C- or vertical crystallographic axes along the costæ (see text-fig. 12). They show " cap-structure " very clearly.

Sections through a pedicle valve which has not been decalcified often exhibit euhedral crystals of quartz penetrating the calcite of the shell substance (see text-fig. 13). These quartz crystals, as seen in thin section, are often cloudy and show growth-lines continuous with those in the surrounding calcareous shell substance. This cloudiness and the lines of growth appear to be due to the inclusion of fragmentary calcite by the quartz ; a thin section of such a clouded quartz crystal becomes clear upon treatment with acid. In thin section, also, the quartz crystals show marked zoning, due in all probability to " cap-structure."

Text-fig. 12.



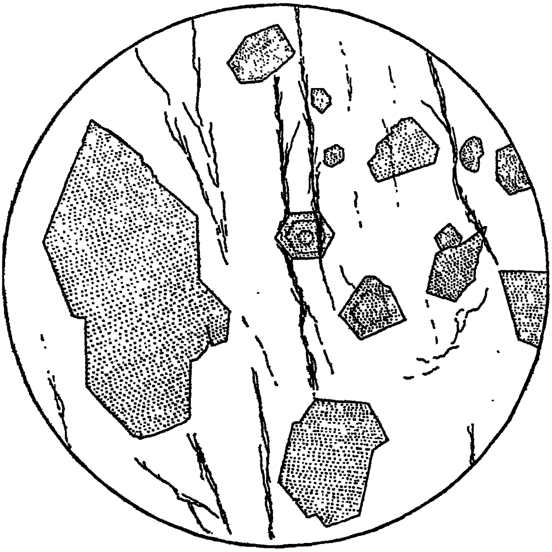
Costæ of *Airtonia hudsoni,* gen. et sp. n., replaced by crystals of quartz.

A shows six costæ from the brachial valve replaced by quartz crystals exhibiting " cap " structure. × 10 approx.

B is a sketch of the brachial valve of the holotype of *A. hudsoni,* showing the position of the costæ depicted in A. × ½ approx.

Frequently, more especially in the aural regions of *Airtonia hudsoni* (internal surface), the quartz crystals are seen to be arranged in concentric rings (see text-fig. 14). A thin section in the plane of one of these rings shows a very definite concentric arrangement of minute inclusions, although the quartz crystals composing the rings are radially disposed. The quartz rings are very similar in

Text-fig. 13.



Text-fig. 14.

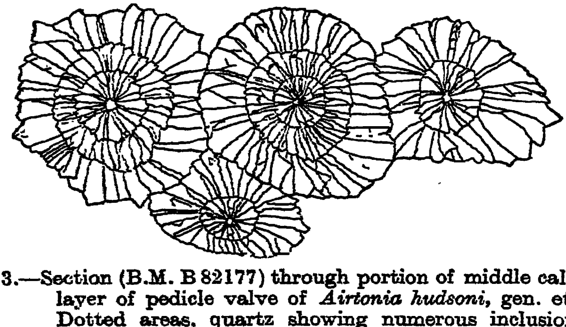


Fig. 13.—Section (B.M. B 82177) through portion of middle calcareous layer of pedicle valve of *Airtonia hudsoni*, gen. et sp. n. Dotted areas, quartz showing numerous inclusions and zoning. Remainder of field, calcite with occasional growth-lines. Diameter of field = 4·3 mm.

Fig. 14.—A group of quartz rings from the inner aural surface of a pedicle valve (B.M. B 86711) of *Airtonia hudsoni*. × 5 approx.

form to the "beekite" rings found on many fossils, more especially on brachiopods. I venture to suggest that "beekite" may actually change over to quartz. Some support is lent to this hypothesis by the silicification of a specimen of *Productus* cf. *auritus* Phill. from the White Cliff coral band of North Derbyshire (4). In this specimen an actual transition from typical "beekite" (chalcedonic) rings, through rings composed partially of "beekite" and partially of quartz crystals, to areas of small but well-developed quartz crystals practically devoid of ring structure is to be seen.

ACKNOWLEDGMENTS.

I wish to thank Miss H. M. Muir-Wood for her advice and criticism and for kindly reading through the manuscript. I am also indebted to Dr. Emily Dix, Dr. L. Hawkes, and Dr. H. Dighton Thomas for their welcome suggestions, and to Dr. R. G. S. Hudson for the loan of material and for numerous details concerning the horizon at which the brachiopods were obtained.

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(2) DELÉPINE, G. 1928. "Les Brachiopodes du Marbre Noir de Dinant." Mém. Mus. Hist. nat. Belg. no. 37, p. 16.

(3) PAECKELMANN, W. 1930. "Die Brachiopoden des deutschen Unterkarbons." Abhandl. preuss. geol. Landesanst. N.F., Heft 122, pp. 220–22.

(4) COPE, F. WOLVERSON. 1933. "The Lower Carboniferous Succession in the Wye Valley Region of North Derbyshire." Journ. Manchester Geol. Assoc. vol. i. pt. 3, p. 140.

EXPLANATION OF PLATE VI.

Airtonia hudsoni, gen. et sp. n.

All are natural size figures of the holotype, British Museum (Natural History), B 86710.

Fig. 1. Ventral valve with brachial valve in position, cardinal process visible in delthyrial opening; strong teeth of pedicle valve fitting into dental sockets of brachial valve.

Fig. 2. Pedicle valve, profile view.

Fig. 3. Pedicle valve, external or ventral aspect.

Fig. 4. Pedicle valve, internal or dorsal aspect; shows single pair of elongate adductor muscle impressions flanked by divaricator muscle impressions.

Fig. 5. Brachial valve, external or dorsal aspect.

Fig. 6. Brachial valve, internal or ventral aspect; shows forked ridges adductor muscle impressions, brachial ridges.

XXVII.—*The African Species of* Hadronotus (*Hymenoptera, Proctotrupoidea, Subfam.* Scelioninæ). By G. E. J. Nixon, B.A.

[Plate VII.]

Except where otherwise stated, the material on which this paper is based was collected by Mr. R. E. Turner in South Africa. Through the courtesy of Dr. Ferrière of the Imperial Institute of Entomology, the author has been enabled further to examine bred series of two species, both of which are here described as new.

The types of all new species are in the British Museum.

The task of preparing this short review has not been altogether easy. The species of *Hadronotus* are difficult, and, though some forms dealt with here are very distinct and easily recognizable by good structural characters, there are also others that are far less easy and of which determination depends on a fine appreciation of sculpture that is not always adequately assisted even by the most careful description.

Where it has been possible to supplement the descriptions by means of outline figures giving a clear idea of obvious differences in structure, this has been done. With regard to the four photographs of wings (Pl. VII.), it should be noted that (*a*) and (*b*) are representative of groups of species, while (*c*) and (*d*) depict the peculiarities of particular species.

The genus *Hadronotus* has been accepted in rather a wide sense, as a consideration of the characters used in the major divisions of the key to the species will perhaps suggest. The motive for this has been to avoid the indiscriminate multiplication of generic or subgeneric names.

The twelve African species discussed below are covered by the following description :—

Head always transverse, at least about twice as wide as its shortest length. Frons with or without a margined impression. Antennæ 12-segmented in both sexes, always with a thick, though not always clearly differentiated, club in the ♀, in the ♂ with the funicle very short, hardly longer than the head and thorax together, except in *festivus* K. Eyes bare or densely clothed with extremely short hairs. Posterior ocelli close to the eye-margin, except in *festivus*. Mandibles unidentate in *festivus*, bidentate in *pisus* and *hiberus*, spp. n., or with three teeth (the middle one small) in the other species. Head never smooth and polished, usually more or less reticulated, and never obviously punctured. Cheeks behind the genal sulcus never striated except in *festivus*, in which species microscopic striations are present. Vertex just behind the posterior ocelli with or without a margin—that is to say, in those species which have the margin, this is continuous with the lateral occipital margin, and forms with it a continuous unbroken ridge; in those species in which the margin is not present, the lateral occipital margin is continued up to the temples, where it turns abruptly inwards forming an obtuse angle, the upper arm of which is normally very short except in *saxatilis* K., in which species it is extended to form a more or less continuous ridge right across the occiput. Sometimes a ridge connects the posterior ocelli. Clypeus inconspicuous and more or less semicircular, except in *festivus* and *pisus*.

Thorax: Mesonotum, in the majority of species, in no sense punctate; only in *festivus* and *pisus* is there some indication of microscopic puncturation. The mesonotum possesses no trace of a specialised area * in front. Scutellum usually transverse; if not markedly transverse, it tends to be gibbous posteriorly as in *charon*, sp. n., and the gibbous part bulges beyond its posterior margin. Fore-wings: subcostalis always well separated from the edge of the wing, except in *hiberus*; marginalis sometimes more or less punctiform and always shorter than the stigmalis, except in *hiberus*; the limits of the postmarginalis are sometimes ill-defined, but it is never shorter than the stigmalis. Postscutellum sometimes simple, sometimes with a feeble transverse swelling as in *charon*, or sometimes with a small and relatively inconspicuous emarginate process as in *janus*, sp. n.

Abdomen not obviously longer than wide, except in *cous*, sp. n., and *hiberus*. In the ♀ there are seven segments visible dorsally; the 6th is 4- not 3-sided as in most other Scelionine genera, and its apical margin is straight or feebly emarginate as in the *nævius*, sp. n., group or very feebly bisinuate as in *festivus*. These characters belonging to the shape of the apical margin of the 6th tergite are slight. They are accordingly not mentioned in the descriptions, and it would be unwise to assign classificatory value to them.

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* See Nixon, "A further Contribution to the Study of South African Scelionidæ," Ann. & Mag. Nat. Hist. ser. 10, vol. xii. p. 289 (1933).

Key to the Species, ♂♀.

1. Vertex very sharply margined just behind the posterior ocelli, the sharp edge forming with the lateral occipital margin a continuous unbroken ridge .... 2.

Vertex not thus margined, so that there is no clear separation between its anterior and posterior (declivous) part .... 7.

2. Eyes completely bare .... 3.

Eyes thickly clothed with very short hairs .... 5.

3. Occiput on its upper part with two or three fine transverse ridges on a smooth surface which originate from the occipital margin itself, but which tend to fade out medially. Sometimes only the lowest of these ridges is present and this always makes an angulation with the occipital margin at the point (on the temples) where it joins the latter .... *saxatilis* Kieffer.

Occiput without a trace of transverse ridges, its surface not easily visible, everywhere smooth. (Species having head and thorax with a very fine even sculpture which gives these parts a dull leathery appearance; the clypeus with acutely pointed lateral angles; the marginalis punctiform.) .... 4.

4. Posterior ocelli remote from the eye-margin, as far distant from this as they are from the anterior ocellus. The subcostalis, at its apical quarter, takes an abrupt and conspicuous downward bend before reaching the marginalis. Mandibles narrow and acutely pointed................................ *festivus* Kieffer.

Posterior ocelli close to the eye-margin, being separated from this by a distance hardly half as great as that separating them from the anterior ocellus. Subcostalis taking only a very slight, inconspicuous, downward curve before reaching the marginalis. Mandibles with two very large, pointed, apical teeth .. *pisus*, sp. n.

5. Marginalis more or less punctiform. Head closely and evenly reticulate .... 6.

Marginalis long, fully as long as the stigmalis. Head vaguely or hardly reticulate .... *hiberus*, sp. n.

6. Frons with a well-defined and completely margined impression. Scutellum feebly notched at its apex and in lateral aspect completely overlapping the postscutellum .... *cous*, sp. n.

Frons with a shallow ill-defined impression, which is margined only above, and the margin itself weak. Scutellum not notched at its apex and in lateral aspect not overlapping the postscutellum .... *janus*, sp. n.

7. Eyes completely bare .... 9.
Eyes thickly clothed with very short hairs. (Species with the marginalis only a little, or hardly, shorter than the stigmalis.) .... 8.

8. Head evenly convex across the vertex in the region of the anterior ocellus; mesonotum with two longitudinal rows of minute, dull black, raised points which are most clearly visible when the insect is viewed slightly from behind. Abdomen of the female black...... *gnidus*, sp. n.
Head somewhat flattened above in the region of the anterior ocellus; mesonotum without such raised points; abdomen of the female more or less honey-yellow .... *antestiæ* Dodd.

9. Frons with a deep well-defined impression, which is completely margined. (Large, robust species 1·9–2·3 mm. in length.) .... 10.
Frons with only a feebly defined, often shallow impression, which is never completely margined. (Small species, at most 1·5–1·6 mm. in length.) .... 11.

10. Side of the head between the genal sulcus and the occipital margin with a *distinct ridge*, which extends from the temples to the mandibles. Postscutellum in lateral aspect not, or hardly, projecting beyond the apex of the scutellum.. *charon*, sp. n.
Side of the head between the genal sulcus and the occipital margin without such a ridge. Postscutellum in lateral aspect distinctly projecting beyond the apex of the scutellum. (A species with the abdomen unusually hairy.) *letus*, sp. n.

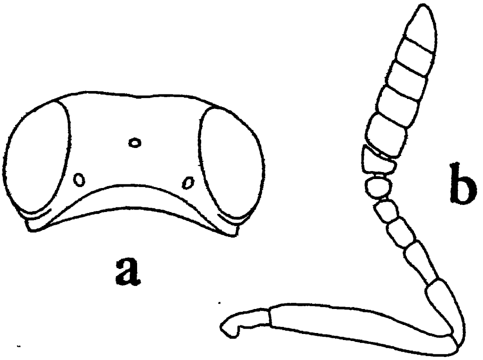
11. Seen from the side, the thorax and the abdomen are very nearly in the same plane. The mesonotum and the scutellum are somewhat flattened. Head a little under twice as wide as its shortest length .... *myndus*, sp. n.
Seen from the side, the thorax and the abdomen are by no means in the same plane. Mesonotum and scutellum quite strongly convex. Head nearly two and a half times as wide as its shortest length .... *nævius*, sp. n.

Hadronotus saxatilis Kieffer. (Fig. 1.)

Hadronotus saxatilis Kieff. Bull. Soc. Ent. France, p. 293, ♂♀ (1910).

The species was originally described from the Seychelles Is. It is a small, very dark insect with the antennal scape infuscated in both sexes, but less so in the Seychellian examples. Kieffer's description of the species is fairly good, but he does not mention either of the characters given in the key. Also, he describes the thorax as "matt und grob lederartig"; in the author's opinion this is not strictly accurate, and to bring the description of the thoracic sculpture into line with his treatment of sculpture throughout this paper he would describe it as very fine and more or less indeterminate; the anterior half or two-thirds of the mesonotum under a high magnification shows minute raised points on a dull surface; posteriorly the mesonotum and also the scutellum are faintly to quite strongly longitudinally striated. In thoracic sculpture *saxatilis* resembles both *gnidus*, sp. n., and *antestiæ* Dodd, but is at once separated from either of these species by its possessing glabrous eyes and a more or less punctiform marginalis, as also by the characters given in the key.

Fig. 1.



Hadronotus saxatilis Kieffer, ♀.
a, head, from above; *b*, antenna.

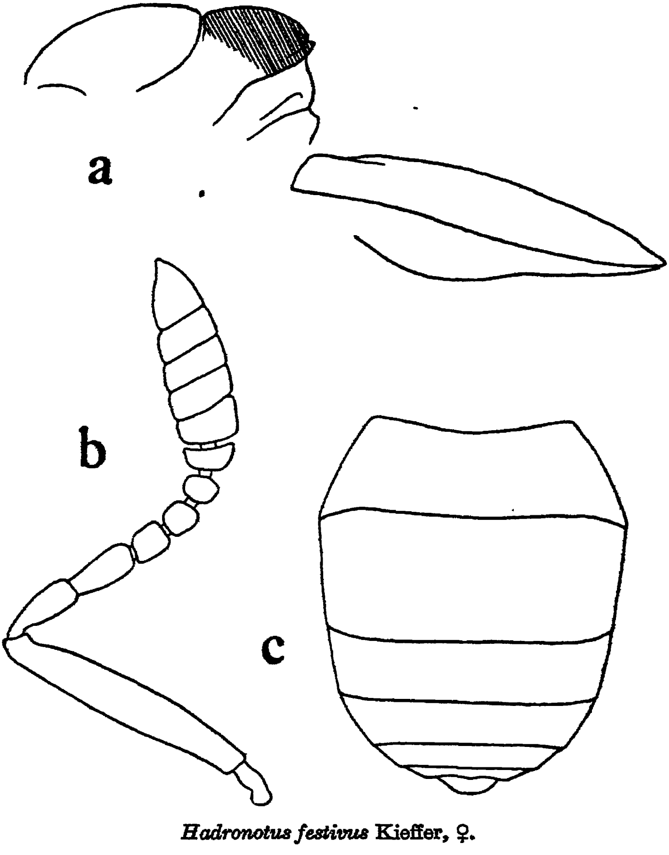
Seychelles; Cape Province (Somerset East, Mossel Bay, Port St. John, Lion's Head, Worcester, Ceres, Queenstown); S.W. Africa (Okahandja).

Hadronotus festivus Kieffer. (Fig. 2.)

The species was described from one male, the type of which is in the British Museum.

♀.—Colour dark brownish-black, the abdomen sometimes paler than the thorax. Scape of antennæ, first few segments of the funicle, mandibles, legs, excluding the coxæ, which are more or less the same colour as the abdomen, pale brownish-yellow. The head and the thorax are without a conspicuous clothing of erect hairs, the vestiture consisting of only microscopically fine adpressed hairs.

Fig. 2.



Hadronotus festivus Kieffer, ♀.
a, thorax, lateral; *b*, antenna; *c*, abdomen.

Head strongly transverse. Frons evenly convex or sometimes weakly impressed, and in this case showing a weak central ridge. Sculpture of frons varying according to the size of the individual; the surface of its middle part weakly shining and with very delicate, sometimes hardly visible, semicircular striations. Frons against the eyes and the vertex, everywhere dull, with a very fine, even, leathery sculpture. Eyes bare, a little longer than their distance from the mandibles. Posterior ocelli fully as far distant from the eye as from the anterior ocellus. Clypeus with acutely pointed lateral angles. Mandibles short, strongly curved, and tapering to a fine point. Head weakly hollowed out behind, so that the thorax fits into it as into a socket; the vertex is hence very sharply margined, the margin having a knife-like edge. Antennæ: segment 1 of the funicle from but little longer than wide to a little over one and a half times as long as wide; 3 and 4 small, as long as wide; 5 transverse, nearer in size to 6 than to 4; 5–10 forming a moderately thick club, which is not more than twice as wide as 1. Cheeks behind the genal sulcus nearly smooth, with some microscopic striations.

Thorax: Mesonotum uniformly dull, its sculpture similar to that of the vertex, but somewhat stronger, and showing more clearly contiguous, microscopically fine punctures, but still very even and leathery. Scutellum sculptured like the mesonotum, seen from the side, raised high above the level of tergite 1 and completely overlapping the rest of the thorax, which falls away perpendicularly beneath it. Postscutellum medially with a smooth or nearly smooth, shining, transverse area. Fore-wings yellowish, extending (see Pl. VII. fig. *c*) only a little, or sometimes hardly, beyond the apex of the abdomen; the venation is brownish and for the most part distinct; the subcostalis at its apical quarter takes an abrupt and conspicuous downward bend before reaching the marginalis; marginalis punctiform; postmarginalis not very clearly defined, but apparently fully 2½ times as long as the stigmalis; the pubescence of the wings is very fine and the fringe very short.

Abdomen somewhat flattened; tergite 1 somewhat depressed over its greater medial part, its ridges very close, fine, regular, and more or less parallel to each other; they do not fade out apically, but tend to become slightly widened, so that the grooves between them are closed apically; 2 finely striated in the middle, but becoming very finely rugose towards the sides; the ridges of 2 are very regular and nearly straight; remaining tergites together longer than 2.

Length 1·3–1·6 mm.

CAPE PROVINCE, Pondoland (Port St. John), *Jan.*, *Feb.*, and *May*, 5 ♀♀ (Ceres), *March*, 1 ♀.

The type-male is from the Seychelles. It has the body, except the head and the apical half of the abdomen, which are blackish, together with the legs, entirely honey-brown. The antennæ are slender, about as long as the body; the segments of the funicle are cylindrical and 2–9 are about one and a half times as long as wide; the segments do not fit closely together, their articulations being distinct, and are clothed with very short, semi-erect, stiff, bristling hairs.

The species is very distinct, and is characterised by the position of the posterior ocelli, by the shape of the mandibles, and by the sharp bend in the subcostalis.

Hadronotus pisus, sp. n. (Fig. 3.)

This species is very similar to *festivus* Kieff. in shape and particularly sculpture. It differs from that species as follows:—

Darker, the body being dull black, the legs with usually only the tibiæ and tarsi brownish-yellow.

Head less transverse, but variable in shape. Frons often with quite a deep impression; generally, the presence of a fairly deep to deep impression is correlated with a less to much less transverse head. Posterior ocelli close to the eye-margin, from which they are very much less distant than from the anterior ocellus. Mandibles shorter, wider, and terminating in two large teeth, which are slightly divergent towards their apex. Antennal club slightly less thick.

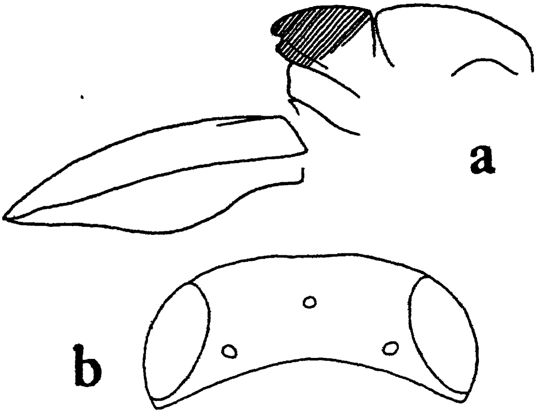
Thorax: In the fore-wings (see Pl. VII. fig. *d*) the subcostalis takes only a slight and gradual downward curve before reaching the marginalis; there is a faint cloud around the marginalis, and this cloud sometimes extends as a band across the wing to its lower margin; also, the apical part of the wing is sometimes faintly darker, thus leaving a narrow hyaline band between itself and the dark band which arises at the marginalis. The scutellum overlaps the rest of the thorax even more completely than in *festivus*, and sometimes projects quite strongly beyond it.

Abdomen: Tergite 2 less conspicuously striated, the greater part of its surface being the more often finely scaly-reticulate, usually the striations being restricted to the extreme base of the segment.

The male differs from that of *festivus* as follows :—

Antennæ shorter, hardly as long as the head and the thorax together, and tapering slightly towards the apex; the segments fit closely into one another; 2–9 of the funicle are sometimes nearly transverse, sometimes even a little longer than wide; the vestiture is closely adpressed and extremely fine, hardly visible; the segments are also thickly beset with minute, silvery, seta-like hairs.

Fig. 3.



Hadronotus pisus, sp. n., ♀.
a, thorax, lateral; *b*, head, from above.

Length 1–1·4 mm., ♂♀.

Cape Province (Somerset East), *Dec.*, *Jan.*; (Port St. John), *March–June*; (Mossel Bay), *Jan.–Feb.*, *June–July*, *Nov.–Dec.*; (Swellendam), *Feb.*; (Ceres), *March*, 27 ♂♂, 24 ♀♀.

This stout, dumpy species is subject to a good deal of structural variation, especially in the shape of the head and the depth of the frontal impression. It is possible that two closely allied species are mixed under this name, but, owing to the lack of bred series, the writer prefers to regard all variations referred to as individual, since intermediate forms occur which would render any separation into more than one species arbitrary.

Their sculpture makes this species and *festivus* very distinct from all the other species dealt with in this paper.

Hadronotus hiberus, sp. n. (Fig. 4.)

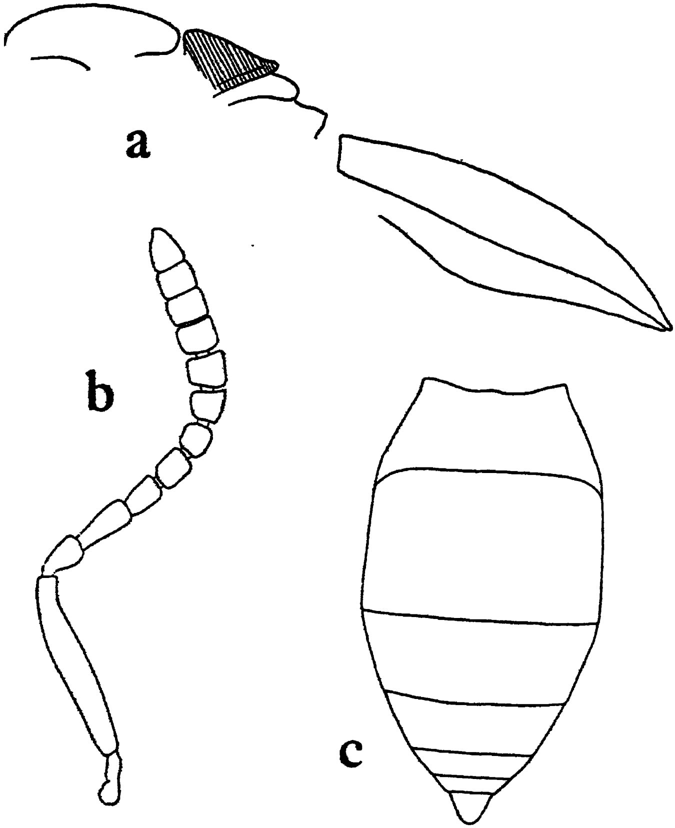
♀.—Colour very dark brownish-black. Scape, pedicel, first five segments of the funicle, and legs (except the darker coxæ) more or less clear honey-brown, though the colour is sometimes obscure.

Head seen from above a little less than, or about, twice as wide as long, thickly clothed with rather long, more or less upstanding, pale hairs. Frons with a fairly deep, more or less oval impression which is sharply and completely margined. Sculpture of frons outside the impression and of the vertex variable; sometimes very finely and vaguely reticulate, the meshes being a little larger than the anterior ocellus (the three specimens which have this sculpture have the head less than twice as wide as long); sometimes finely scabrous, with tiny raised lines, which form a very incomplete reticulation (one specimen, the largest, with the head twice as wide as long; in this individual a complete ridge, which is only feebly indicated in the others, joins the frontal impression with the anterior ocellus). Posterior ocelli separated from the eye-margin by a distance about equal to, or a little greater than (in largest specimen), their own diameter. Eyes densely clothed with short upstanding hairs. Cheeks behind the genal sulcus extremely finely scaly-reticulate, without striations. Clypeus with its lateral corners rounded. Mandibles narrowed towards the apex, with two tiny teeth, the upper one the longer. Occiput completely and sharply margined, the occiput itself falling more or less perpendicularly away from this margin. Antennæ somewhat slender, the funicle unusually hairy; first four segments of the funicle together about two-thirds as long as the following segments; 1 narrow, cylindrical, a little more than twice as long as its greatest width; 2 a little shorter, or hardly shorter, than 1; 3 a little longer than wide; 5 intermediate in size between

4 and 6; 6 fits closely into 5, but not 5 into 4, so that the weak club appears to be 6-segmented.

Thorax: Mesonotum weakly shining, very finely granulate towards the front, but showing posteriorly a tendency to become finely but indistinctly longitudinally rugose. Scutellum somewhat dull, exceedingly finely and closely scaly-reticulate, almost granulate; when seen

Fig. 4.



Hadronotus hiberus, sp. n., ♀.
a, thorax, lateral; *b*, antenna; *c*, abdomen.

from the side the scutellum does not overlap the rest of the thorax at all. Propodeum very short, truncated; the two sharp ridges, which enclose a median space, do not quite meet in the middle, but diverge towards the posterior margin of the postscutellum. Fore-wings faintly brownish, the pubescence somewhat rough; subcostalis very close to the edge of the wing, not curved, and forming with the marginalis a straight line; marginalis thicker than the subcostalis and slightly longer than the stigmalis; postmarginalis fully three times as long as the stigmalis. Legs very slender.

Abdomen nearly twice as long as wide. Segment 1 quite simple at the base; 2 about twice as long as 3, with fine, very irregular wrinkles on a scaly-reticulate surface; in one specimen the scaly-reticulate sculpture predominates; in another (the largest) the longitudinal wrinkles are stronger and more regular.

Length 1·6–1·8 mm.

Cape Province (Pondoland, Port St. John), *July*, 3 ♀♀; *Aug.*, 1 ♀ (the largest).

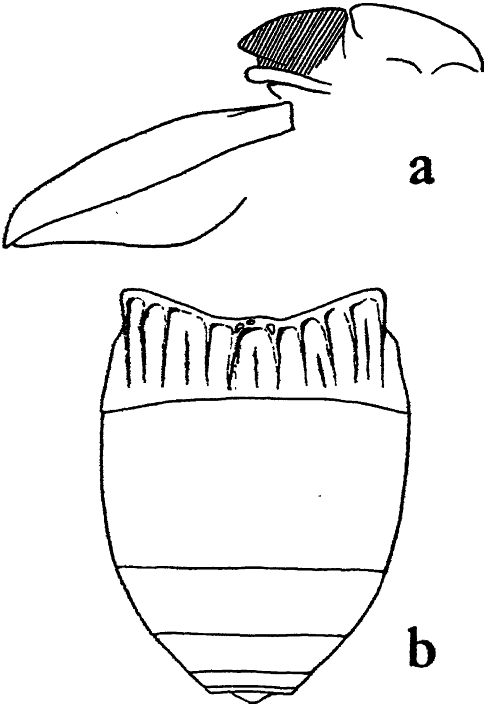
A very distinct species, characterised by the margined occiput and the long marginal vein of the fore-wing. On account of this last character and its slender form, the insect is by no means typical of the genus, and is placed here only provisionally.

Hadronotus cous, sp. n. (Fig. 5.)

Dull black. Scape and first four segments of the funicle pitchy brown. Legs with the coxæ and the femora in greater part nearly black; tibiæ and tarsi reddish-brown.

Head hardly wider than the thorax, somewhat dull, beset with extremely short semi-erect, rather bristly hairs. Frons with a deep, well-defined impression which is completely margined; this impression is quite strongly widened towards the mouth of the insect; its distance from the anterior ocellus is about equal to that of the anterior ocellus from the eye; there is no trace of a ridge joining the frontal impression with the anterior ocellus. Frons otherwise, right down to the genal sulcus and the vertex, very sharply, closely, and evenly reticulated, the meshes are about as large as the anterior ocellus; they tend to become smallest along the occipital margin and largest towards the genal sulcus. The occiput is very sharply margined, so that it is separated from the vertex by a knife-like edge; the occipital region is somewhat strongly transversely rugose or striate; the head behind is not so concave and hence not so socket-shaped as in *festivus* and *pisus*. Clypeus so undeveloped as to appear more or less absent. Eyes densely clothed with very short upstanding hairs. Mandibles with three small teeth, the middle one minute, the upper one the longest. Antennæ short and stout; segment 1 of the funicle about one and a half times as long as its greatest width;

Fig. 5.



Hadronotus cous, sp. n., ♀.
a, thorax, lateral; *b*, abdomen.

3 and 4 about as long as broad; 5 much nearer in size to 6 than to 4, and forming first segment of only a moderately thick club. Posterior ocelli almost touching the eye-margin.

Thorax: Mesonotum finely, but quite strongly, longitudinally rugose, the rugosities close and finely wrinkled. Scutellum completely covering the rest of the thorax when seen from the side, though not projecting markedly beyond it; it is feebly notched at the apex and is reticulated like the head, but more coarsely so. Postscutellum longitudinally costate throughout, and with a tiny medial projection. Fore-wings short, brownish, the fringe very short; the subcostalis takes only a slight and gradual downward curve before reaching the punctiform marginalis; stigmalis somewhat short; postmarginalis more or less wanting. Legs with the spur of the hind tibiæ reddish-brown and unusually strong, being nearly half as long as the first segment of the tarsus.

Abdomen distinctly longer than broad, somewhat flattened, and everywhere very strongly sculptured; segment 1 with strong longitudinal wrinkles, which are rather wide apart and sometimes ill-defined; 2 sculptured all over like 1, and with the intervals between the strong wrinkles indefinitely rugose; 3 and 4 similarly, but less definitely, sculptured. The abdomen of this species is longer and narrower than any of the other species discussed in this paper except *hiberus*, sp. n.

The male differs from the female as follows:—Antennæ short, slender; segments 2 to 9 almost square in outline; the funicle is thickly clothed with very short, pale, semi-erect hairs. Distance of the frontal impression from the anterior ocellus but little more than half that of the anterior ocellus from the eye.

Length, ♂♀, 1·8 mm. approx.

CAPE PROVINCE (Port St. John), *March*, 2 ♂♂; *Dec.*, 1 ♀.

A very distinct species, characterised by its rather elongate form, hairy eyes, and strong sculpture. The long spur of the hind tibiæ is a difficult character to appreciate, unless comparison be made with some of the other South African species. This insect could be confused only with the following species.

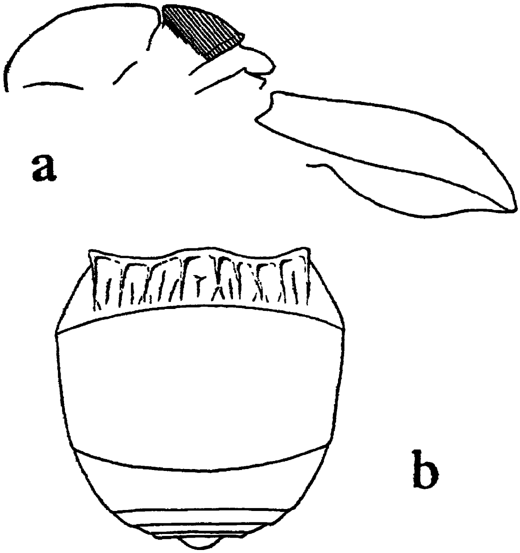
Hadronotus janus, sp. n. (Fig. 6.)

A species closely related to *H. cous*, sp. n., but smaller, less elongate, less strongly and less characteristically sculptured, especially with regard to the abdomen. It differs from *cous* as follows :—

Colour : The legs are obscure yellowish-brown rather than reddish-brown.

Head : Frons with a shallow, not completely margined impression ; above it is delimited by a feeble margin. Mandibles slightly narrowed towards their apex and with two tiny teeth. Antennæ stouter, the funicular segments more closely-set ; first four segments of the funicle less than half as long as the club ; 4 strongly transverse ; club thicker, less elongate, at its widest it is fully three times as wide as 1.

Fig. 6.



Hadronotus janus, sp. n.
a, thorax, ♂, lateral ; *b*, abdomen, ♀.

Thorax : Mesonotum less distinctly longitudinally rugose, but still quite strongly rugose. Scutellum slightly less transverse, less strongly reticulate, and not notched at its apex. Postscutellum medially with a small emarginate process, which in lateral aspect projects beyond the scutellum.

Abdomen less elongate, about as long as broad; segment 2 considerably longer in proportion to the following segments together, everywhere finely and irregularly striate-reticulate, but towards the base the striate element in the sculpture predominates.

The antennæ are more or less similar to those of *cous*, sp. n.

Length, ♂♀, 1·3 mm. approx.

CAPE PROVINCE (Port St. John), *July*, 1 ♀, *Dec.*, 1 ♂; (Ceres), *March*, 1 ♂.

This and the preceding species would appear to belong to a conveniently separable group of the genus, characterised by the sharply margined vertex and the hairy eyes. With regard to these two characters, they agree with *H. hiberus*, sp. n., but otherwise have little in common with it.

Hadronotus gnidus, sp. n.

This species is extremely like *antestiæ* Dodd, and the structural and sculptural differences which separate the two species are subtle and difficult to appreciate. The females of the two forms can, however, be separated at once by the striking difference in the colour of the abdomen. It is largely on the strength of this colour-character, which appears to be constant throughout a number of bred series of both species, that the writer separates *gnidus* from *antestiæ*. *Hadronotus gnidus*, sp. n., differs from *Hadronotus antestiæ* Dodd as follows:—

♂♀.—Legs with all the femora in greater part infuscated, the tibiæ and tarsi obscure brownish-yellow. Abdomen entirely black.

Head slightly less transverse and evenly convex across the vertex in the region of the anterior ocellus.

Thorax: Like *antestiæ*, the sculpture of the mesonotum is, in greater part, extremely fine and indeterminate. Dodd's description of the mesonotum and scutellum of *antestiæ* as being "moderately longitudinally rugose" is misleading; only on its posterior third or quarter has *antestiæ* distinct, though extremely fine, longitudinal rugosities or striations. If *gnidus* shows such rugosities, they are, by comparison with the rest of the sculpture, much less conspicuous. When viewed from behind, the mesonotum usually shows two longitudinal rows of minute raised points; these points appear dull and blacker than the rest of the mesonotal sculpture, with which they form a slight contrast; sometimes there are as few as five or six of them in each row, but more frequently they form a narrow band. Fore-wing (see Pl. VII. fig. *a*).

Length 1 mm., ♂♀.

ANGLO-EGYPTIAN SUDAN (Wad Medani), *A. B. Johnston*: a series of 15 ♀♀, 4 ♂♂, bred from eggs of a Hemipteron on *Cajanus indicus* at the Wellcome Tropical Research Laboratories; (Khartoum), *H. M. Bedford*: series of 10 ♀♀, 4 ♂♂, bred from eggs of Pentatomid bug of *Abutilon* sp. UGANDA (Kampala), *H. Hargreaves*: series of 10 ♀♀, 4 ♂♂, bred from Coccid eggs.

In the last-mentioned series the females have the antennæ distinctly less hairy than those of the other two series.

Hadronotus antestiæ Dodd.

Hadronotus antestiæ Dodd, Trans. Ent. Soc. London, p. 351 (1919).

Distribution.—KENYA COLONY (Nairobi), *T. J. Anderson*: series bred from eggs of the coffee bug, *Antestia orbitalis* West. (=*variegata* St.). TANGANYIKA TERRITORY (Moshi), *A. N. Ritchie*: series of 18 ♀♀, 4 ♂♂, bred from eggs of *Antestia lineaticollis* St. SUDAN (Wad Medani), *W. P. L. Cameron*: series of 6 ♀♀, bred from eggs of *Agonoscelis versicolor* Fab. S. INDIA (Coimbatore), *P. S. Nathan*: 8 ♀♀, 2 ♂♂, from Coreid eggs on leaves of *Cajanus*.

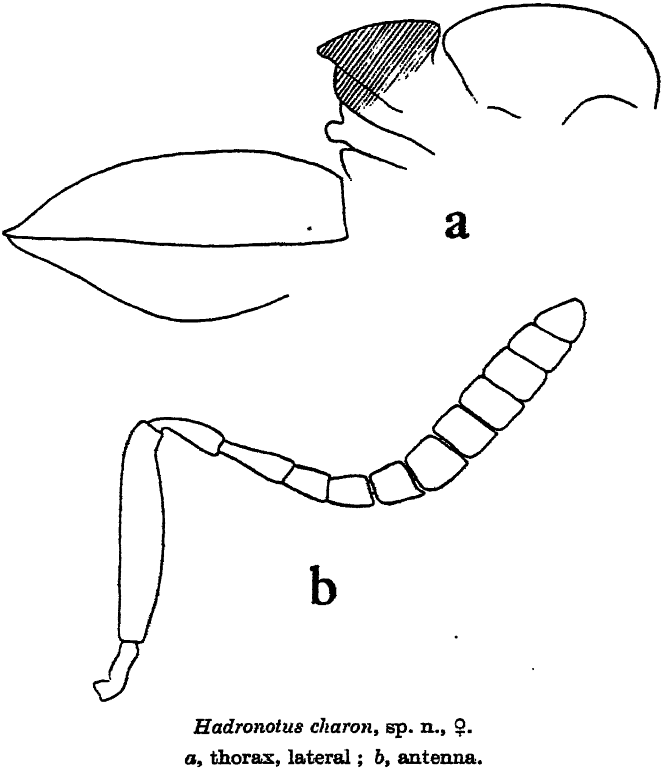
This species is mentioned in connection with *H. gnidus*, sp. n., and *H. saxatilis* Kieffer.

Hadronotus charon, sp. n. (Fig. 7.)

♀.—Colour black or nearly black. Scape of the antennæ, the pedicel, and first four segments of the funicle, although these latter are sometimes infuscated, and the legs (except the coxæ) bright reddish-yellow.

Head from above about two and a half times as wide as its shortest length. Frons with a completely and sharply margined impression, which is about twice as long as wide and is slightly narrowed in the middle; this impression is somewhat vaguely transversely striated; above, it is connected by a short carina with the anterior ocellus. Frons otherwise and the vertex weakly shining, their general sculpture finely scabrous, with tiny or minute, irregularly placed, and scattered raised lines, which on the frons towards the genal sulcus form themselves into indistinct reticulations. Vertex produced to form a feeble to strong ridge between the posterior ocelli; this ridge sometimes passes in front of the posterior ocelli and comes to touch the eye-margin; behind the ridge the vertex falls obliquely away and becomes merged with the occiput; here the surface is transversely rugose or simply rugose. Posterior ocelli separated from the eye-margin by about their own diameter. Eyes bare. Clypeus semicircular. Face behind the genal sulcus with a distinct ridge, which extends upwards from the mandibles to the eye midway between the genal sulcus and the occipita margin. Mandibles with three tiny teeth, the upper one

Fig. 7.



Hadronotus charon, sp. n., ♀.
a, thorax, lateral; *b*, antenna.

the biggest and longest. Antennæ slender; funicle very gradually thickened towards the apex; funicle 1 fully twice as long as wide; 2 a little longer than wide; 4 intermediate in size between 3 and 5; 4 fits almost as closely into 3 as 5 into 4, so that the club is 7-segmented; club itself slender, its middle segments hardly twice as wide as 2.

Thorax: Mesonotum very strongly convex, strongly and evenly rugose, the sculpture consisting of irregularly shaped points; the sides of the mesonotum behind are distinctly and strongly compressed, as are also the sides of the scutellum, giving the thorax a very distinctive appearance; at the point where the compression is strongest the surface becomes entirely smooth; the scutellum otherwise is coarsely reticulate-rugose, feebly notched at its apex, and sometimes shows a vaguely defined, central, longitudinal groove; in some specimens the scutellum is but little transverse; seen from the side it completely overlaps the rest of the thorax and is raised high above the level of the abdomen. Postscutellum costate throughout, without a distinct medial process. Pleuræ everywhere with very strong sculpture. Forewings with a yellowish tint, and extending well beyond the apex of the abdomen; the pubescence is not close nor fine; the venation is very pale; subcostalis hardly curving downwards before reaching the marginalis; marginalis nearly punctiform; postmarginalis nearly twice as long as the stigmalis. Propodeum with a transverse semicircular carina.

Abdomen strongly convex, but little longer than wide; segment 2 with close longitudinal wrinkles on a finely rugose surface.

The male differs from the female as follows:—

♂.—Antennæ short, yellowish-brown, darker towards the apex; the funicle is slightly clavate—that is, segment 9 is slightly narrower than 6; segment 1 of funicle about one and a half times as long as wide; 4–9 nearly square in outline; the entire funicle is clothed with pale, very short, semi-erect hairs, which do not obscure the shining surface of the segments.

Length about 2·2 mm.; one small ♂ measures 1·7 mm.

CAPE PROVINCE (Port St. John), *March–Aug.*, 3♂♂, 3♀♀; (Mossel Bay), *June–July*, 1 ♀. S.W. AFRICA (Okahandja), *March*, 1 ♂, 1 ♀.

The species is characterised chiefly by the compressed sides of the mesonotum and by the extra ridge on the side of the head.

Hadronotus letus, sp. n.

This species is very similar to *charon*, sp. n. It differs as follows :—

♀.—Colour darker, all the femora nearly black or dark brown. The scape, first four segments of the funicle, obscure reddish-brown, funicular 4 the palest, 5 pale beneath. Tibiæ and tarsi obscure reddish-brown.

Head : There is no distinct ridge between the genal sulcus and the occipital margin, extending from the mandibles to the temples. The vertex is less produced between the posterior ocelli and does not form such a sharp separating ridge ; sometimes there is no ridge at all present ; if one does exist, it is but little stronger than any of the transverse ridges of the declivous part of the vertex. Antennæ with segment 1 of the funicle more slender, about three times as long as wide.

Thorax : Mesonotum less compressed at the sides. Scutellum strongly transverse. Postscutellum with a small, medial, emarginate process, which in lateral aspect projects beyond the apex of the scutellum. Wings darker (see Pl. VII. fig. *b*), the venation brownish and hence more sharply defined ; the marginalis is about twice as long as wide.

Abdomen much more hairy. To the naked-eye the hairs give the abdomen, when this is seen from the side, a faint greyish appearance, which contrasts with the blackness of the thorax.

♂.—The antennæ have the funicle much more slender ; funicular 1 is about two and a half times as long as wide ; 4–9 cylindrical, nearly one and a half times as long as wide.

GOLD COAST (Aburi), *W. H. Patterson* : series of 20 ♀♀, 2 ♂♂, bred from eggs which were laid in chains, and which were probably those of a Hemipteron belonging to the family Coreidæ.

Both this and *charon*, sp. n., are fine large insects, compared with most other African species of the genus, and are of very stout robust build.

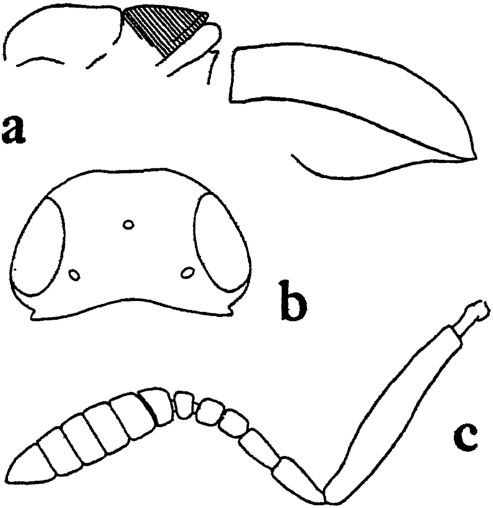
Hadronotus myndus, sp. n. (Fig. 8.)

This species is closely related to *nævius*, sp. n., but evidently quite distinct from it. It is a diminutive insect, smaller than *nævius*, in size about equal to *H. saxatilis* Kieffer. It differs from *nævius* as follows :—

♀.—*Colour* : the light parts are on the whole darker ; the scape of the antennæ has its apical half or two-thirds strongly infuscated ; the proximal five segments of the funicle are almost as dark as the club.

Head less transverse, about 7 : 4 ; when seen from above, it appears quite strongly produced between the eyes, almost subconical. The frons outside the feeble unmargined impression is as delicately reticulated as *nævius*, but more clearly.

Fig. 8.



Hadronotus myndus, sp. n., ♀.
a, thorax, lateral ; *b*, head, from above ; *c*, antenna.

Thorax : The mesonotum and the scutellum are somewhat flattened, the sculpture is less raised and appears slightly finer than in *nævius*. When seen from the side, the scutellum, in comparison with that of *nævius*, is not raised high above the abdomen, with which it is nearly on the same level. The postscutellum has a small transverse swelling in the middle, which projects a little beyond the apex of the scutellum. Wings with the venation slightly darker than in *nævius* ; the marginalis is slightly longer, sometimes nearly two-thirds as long as the stigmalis.
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Abdomen less strongly convex ; tergite 2 with its ground-sculpture distinctly scaly-reticulate, the delicate wrinkles being restricted to the basal half of the segment Following tergites finely scaly-reticulate.

♂.—Antennæ with the funicle entirely dark, nearly black. Otherwise like the ♀.

Length 1·2 mm. approx.

CAPE PROVINCE (Mossel Bay), *Feb.*, 5 ♂♂, 4 ♀♀ ; *June*, 1 ♀.

This species is also closely related to *H. leptocorisæ* Nixon*, from Java. The head is different in shape and *leptocorisæ* has the radicle of the antennæ much longer in proportion to the length of the scape than *myndus*.

Hadronotus nœvius, sp. n. (Fig. 9.)

♀.—Black. Scape, pedicel, and first five segments of the funicle and legs, except the coxæ, pale reddish-yellow.

Head appearing strongly transverse, a little over twice as wide as long. Frons with only a very feeble impression, which is nowhere margined and which is indicated by delicate, very irregular, transverse lines on a shining surface ; the frons elsewhere and the vertex up to the posterior ocelli are delicately and somewhat vaguely reticulated ; around the frontal impression the reticulations become confused with the transverse raised lines. Posterior ocelli sometimes connected by a very feeble ridge. Occiput not margined above. Eyes completely bare. Posterior ocelli separated from the eye-margin by a distance a little greater than their own diameter. Clypeus short, more or less semicircular. Mandibles with three tiny teeth, the upper one the longest. Antennæ: segment 1 of the funicle about one and a half times as long as its apical width ; 2 and 3 about as long as wide ; 4 transverse, slightly saucer-shaped ; 5 nearer in size to 6 than to 4, so that the club is 6-segmented. The club has 5 black segments, of which 2–5 are strongly transverse. The occipital margin turns inwards at the temples to form a tiny angulation.

Thorax : Mesonotum strongly convex, evenly and somewhat finely rugose, the rugosities consisting of tiny, irregularly shaped, raised points ; posteriorly these rugosities tend to become longitudinal, and between them the surface is glistening. At the sides, behind, the mesonotum is slightly compressed in the manner of *H. letus*, sp. n., but this is not so conspicuous a feature as in that species. Scutellum quite strongly transverse, not notched at the apex, its sculpture similar to that of the mesonotum, but with a weak tendency towards reticulation; seen from the side, the scutellum is raised high above the level of the abdomen, but does not completely overlap the postscutellum. Postscutellum costate throughout, with only a very feeble medial process on its apical margin. Fore-wings large, about twice as long as the abdomen; colour, venation, and vestiture as in *H. charon*, sp. n.

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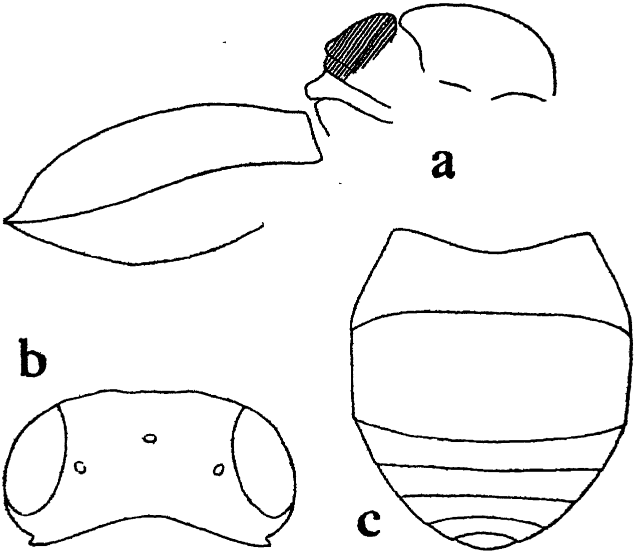
* ' *Stylops*,' vol. iii. pt. 1, p. 3 (1934).

Fig. 9.



Hadronotus nævius, sp. n., ♀.
a, thorax, lateral; *b*, head, from above; *c*, abdomen.

Abdomen a little longer than wide, 5 : 4, strongly convex. Tergite 2 either with very delicate wavy wrinkles over nearly all its surface or with the wrinkles restricted to the base of the segment, and the rest of the surface finely scaly-reticulate; the writer has before him intermediate forms.

♂.—Antennæ short, yellowish-brown, darker towards the apex ; segments 4–9 of the funicle hardly as long as wide ; funicle clothed with very short, pale, semi-erect hairs.

In all other respects the male resembles the female.

Length, ♂♀, about 1·4 mm.

CAPE PROVINCE (Mossel Bay), *Aug.*, 3 ♀♀ ; *Nov.*, 1 ♂ ; (Port St. John), *March*, 1 ♂ ; *July*, 1 ♀.

This species is closely related to both *H. letus*, sp. n., and *H. charon*, sp. n., but it can be distinguished from them by its smaller size and its unmargined frontal impression.

Another, and doubtful, species from South Africa, represented by four individuals from different localities, is very like *nævius*, sp. n., except that it has a more or less completely margined frontal impression and is slightly larger in size. It would appear to be intermediate between *nævius* and *letus*, spp. n. Nevertheless, the writer prefers not to describe these specimens as new, partly owing to lack of sufficient material, and partly because he is not altogether satisfied that the presence of a complete margin bordering the frontal impression is always a character of reliable specific value, for in one of the examples, a ♀ from S.W. Africa (Okahandja), this margin is only feebly developed. On the other hand, this intermediate form may represent a further, and closely allied, species. The examination of further material would no doubt settle the point. *H. nævius, letus, charon*, spp. n., and the preceding species, together with the above-mentioned forms, are closely related to *H. homœoceri* Nixon * and *H. oophagus* Nixon *, species from Java, and with them form a natural species-group of *Hadronotus*. The four individuals discussed above, which are intermediate between *nævius* and *letus*, spp. n., are very close to the two Javanese species on account of their possessing a margined frontal impression. To separate them from their Javanese relatives would be a matter of some difficulty.

EXPLANATION OF PLATE VII.

Fig. a. *Hadronotus gnidus*, sp. n.
Fig. b. —— *letus*, sp. n.
Fig. c. —— *festivus* Kieffer.
Fig. d. —— *pisus*, sp. n.

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* ‘*Stylops*,’ vol. iii. pt. 1, p. 3 (1934).

XXVIII.—*Notes on some Avian Cestodes.* By J. R. Hudson, Division of Veterinary Research, Kabete, Kenya.

I. THE GENUS *KILLIGREWIA* MEGGITT, 1927.

The genus *Killigrewia* was created by Meggitt to include two new species described by him from the Looss collection and the species *Bertiella aberrata* Nybelin, 1916. The type of the genus was named as *Killigrewia frivola* Meggitt, 1927, and the other new species described was *Killigrewia pamelæ* Megitt, 1927. Fuhrmann (1932) states that he has examined specimens from the same bird (*Turturœna sharpei*) from the same collection as *Killigrewia pamelæ* and that in his opinion they are *Aporina delafondi* (Railliet, 1892). He states that the genus *Killigrewia* is therefore a synonym of *Aporina* Fuhrmann, 1902. The type-species, *Killigrewia frivola*, is not mentioned.

According to the intentions of the 'Code of Nomenclature' for two genera to be synonyms it should be shown that the two genotypes are congeneric. Through the kindness of Dr. Baylis, the writer has been able to examine the cotypes of Meggitt's species and to compare them with a specimen of *Aporina* from the Isle of Wight in the British Museum Collection and with a specimen of his own collected in Kenya. The cotype material examined included both specimens mounted by Meggitt and freshly stained worms. Unfortunately, none of the specimens of *Killigrewia* in the material had ripe segments, so that the size of the eggs given in the original description could not be verified.

Otherwise the writer found that the species *Killigrewia frivola* agreed in every detail with the published description of *Aporina delafondi* (Raillet, 1892). It differed from the Isle of Wight specimen only in that in the former a genital pore was present throughout the strobila, whereas in the latter no distinct pores at the edge of the segment could be found. In the specimen from *Streptopelia semitorquata semitorquata* from Kabete, Kenya, a genital pore was present in the young segments only. Variation in this respect in *Aporina delafondi* has been recorded (Baer, 1927).

In the original description of *Killigrewia frivola*, Meggitt stated that the host-name on the tube was illegible. Dr. Baylis informed the writer that he had been able to decipher the words "vielleicht *Neophron percnopterus*." It would appear that the name of the host was in doubt and that the tube was wrongly labelled, or that the specimens were found in a vulture after it had eaten the original host.

The cotypes of *Killigrewia pamelæ* in the British Museum Collection are specimens in a poor state of preservation. They are young examples probably of a species of *Aporina*. The genital pores are distinct to the end of the strobila.

Meggitt's genus *Killigrewia* can, however, be regarded as a synonym of *Aporina* Fuhrmann.

II. THE STATUS OF *RAILLIETINA* (*PARONIELLA*) *MAGNINUMIDA* JONES, 1930.

Miss Jones in 1930 described provisionally as *Raillietina magninumida* specimens of a tapeworm from the guinea-fowl which differed from *Raillietina numida* (Fuhrmann, 1912) only in their greater dimensions and in having a greater number of testes. The two species agree in having rostellar hooks of the same size and number, in having a rather characteristic arrangement of spines on the cirrus, and in the shape of the vaginal bulb. Miss Jones was careful to state that if specimens of intermediate size were found her species would have to be considered a synonym of *Raillietina numida*.

The writer has met with such specimens both in his own collection and in that of the British Museum. The principal measurements are given in the table (p. 316), from which it will be seen that *Raillietina numida* (Fuhrmann) is a variable species of which *Raillietina magninumida* Jones must be regarded as a synonym.

III. THE TAPEWORMS OF THE LESSER FLAMINGO (*PHŒNICONAIAS MINOR* GEOFF.).

Judging by the absence of any record in Fuhrmann (1932), no cestodes have been recorded from this bird. The writer has received two batches of material, one from Kabete from Mr. W. Fotherington and one from the Narok Road, Kenya, from Dr. van Someren. The former consisted of two specimens of *Amabilia lamelligera* (Owen, 1835), and the latter, unfortunately preserved in Uganda spirit, of a species of *Hymenolepis* which appears to be new.

Material.	Length (mm.).	Breadth (mm.).	No. of testes.	Remarks.
Raillietina numida (Fuhrmann).	20	0·24	7–10	Embryo 30 μ.
Specimens from *Guttera edouardi* Ngong, Kenya.	..	0·30	9–13	Material consists of fragments.
Specimens from guinea-fowl, Uganda (British Museum).	...	0·40	11–13	Fragment.
	13	..	..	Last segment mature.
	16	..	..	Last segment shows beginning of capsule formation.
	39	0·70	18	Last segment almost ripe.
Specimens from *Numida mitrata reichenowi* from Coryndon Museum.	90–100	0·80	9–15	Embryo, 29 × 16 μ.
Raillietina magninumida Jones.	100–150	1·3	13–18	......

Hymenolepis phœniconaiadis, sp. n. (Figs. 1–3.)

A rather large fleshy worm, length 80 mm., maximum breadth 3 mm., this species has a large number of segments. The scolex is of the usual shape found in this genus, and has a well-developed rostellum armed with eight hooks 186 μ in length. The hooks have a relatively long base.

The segments are much broader than long and the posterior edges overlap the anterior edges of the following segments. There are 100 bundles of longitudinal

Fig. 1.

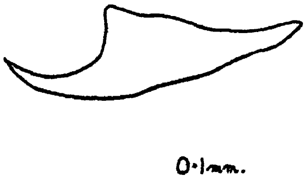


Fig. 2.

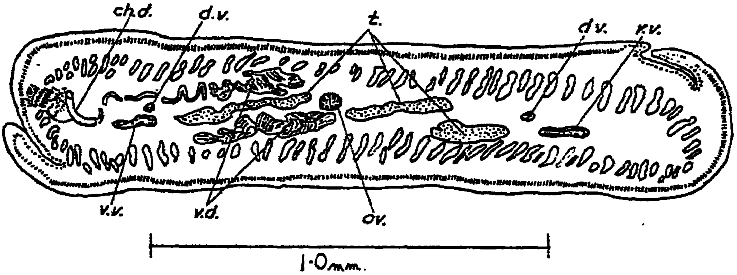
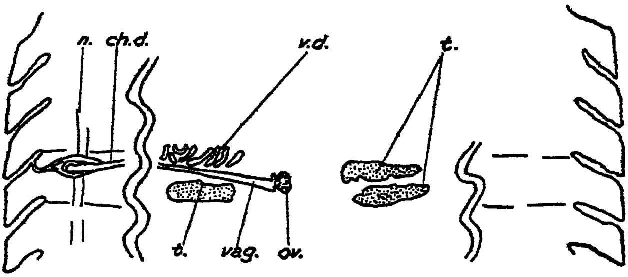


Fig. 3.



Hymenolepis phœniconaiadis, sp. n.

Fig. 1.—Hook.
Fig. 2.—Transverse section of mature segment.
Fig. 3.—Longitudinal section of younger mature segment.

ch.d., portion of male duct that appears chitinized; *d.v.*, dorsal longitudinal vessel; *n.*, lateral nerve; *ov.*, ovary; *t.*, testis; *vag.*, vagina; *v.d.*, coils of vas deferens; *v.v.*, ventral longitudinal vessel.

muscular fibres. The ventral excretory vessel is much larger than the dorsal and, as in all species of the genus, the genital canals pass dorsal to the dorsal vessel.

The cirrus-sac reaches about one-third of the way from the pore to the vessels. There is an internal seminal vesicle. In the middle third of the area between the pore and the vessels the male duct consists of a thin straight tube which in sections has the appearance of a chitinous structure. The coils of the vas deferens are very numerous in the region of the poral testis and appear very prominent when packed with sperm.

The aporal testes are situated one anterior, dorsal and medial to the other. The ovary is placed a little poral to the centre of the segment. The vagina, after passing the vessels, dilates and forms a straight wide tube ending in the neighbourhood of the ovary. The uterus begins as a finely reticular structure, but in the riper segments is sac-like. None of the specimens contained ripe eggs.

Of the three species of *Hymenolepis* with the largest hooks one, *Hymenolepis liguloides* (Gervais, 1847), is from the flamingo. The new species differs from this species not only in the larger size of its hooks, but also in their shape.

Host: *Phœniconaias minor* (Geoff.). Narok Road, Kenya.

The types have been presented to the British Museum (Natural History).

The writer wishes to express his thanks to Dr. Baylis for permission to examine specimens in the British Museum (Natural History), and for help with the literature, and to Mr. Daubney, Chief Veterinary Research Officer, Kabete, for his help and for permission to publish this paper.

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MISCELLANEOUS.

The Use of Cellophane for covering dry Microscopic Slides.

By Sir SIDNEY F. HARMER, K.B.E., Sc.D., F.R.S.

A FEW hints on the preparation of dry slides, the result of nearly fifty years of experience, may perhaps be useful to fellow-workers on calcareous organisms.

Specimens of Polyzoa are conveniently mounted on wooden slides of the standard length (3 in.=75 mm.) and either 1 in. (26 mm.) or 1½ in. (39 mm.) in width. A circular hole, 19 or 30 mm. in diameter, is cut through the middle of the slide. Each size should include about four thicknesses, respectively 3, 5, 6, and 7 mm. A specimen encrusting a stone or shell can only be looked at from above; and for such objects the slide may be backed by a strip of thin black card. Others of an erect habit require examination from both surfaces; and for these a glass slide, as thin as possible, should be used. The attachment can be made so quickly, using seccotine, that the simplest course is to receive the slides unbacked and to affix the kind of back required at the time when the preparation is being made.

It is essential to mount every specimen on the shallowest slide available, in order to keep its surface as nearly as possible level with that of the slide, and thus to permit examination with a reasonably high magnification. In practice I habitually use a binocular microscope with a Zeiss "B" objective, which has a focal distance long enough to avoid risk of injury to the projecting parts of the specimens.

Gum tragacanth is used for attachment. If it is desirable to clean or re-arrange the specimens the addition of a few drops of water will render the cement mucilaginous. The Polyzoa, like certain molluscan shells such as those of *Cypræa*, are liable to the attacks of a disease which produces a copious white and granular deposit on the surface, materially injuring the whole of the calcareous parts. The nature of the disease is at present unknown, but washing with dilute formalin seems to be at least a temporary remedy.

It is essential to use some sort of cover, partly to keep the specimens dust-free and partly to avoid the loss of fragments which may become detached. The older specimens in a museum are frequently uncovered, in which case surface details are obscured by dust. If they are protected it has generally been done by using an ordinary cover-glass, often held in place by the labels. This method may prove unsatisfactory, as has been the case with a large number of slides which I mounted for the University Museum of Zoology, Cambridge, many years ago, using gum tragacanth to which thymol had been added in order to keep it free from micro-organisms. In the course of years the thymol has sublimed in innumerable droplets on the lower surface of the cover-glasses. It is impossible to examine most of these specimens satisfactorily without removing the covers—a proceeding which not only takes time but generally involves some injury to the writing on the original labels.

Mr. E. Heron-Allen, F.R.S., has invented an ingenious form of sheath which avoids these troubles, and has used it for the protection of his fine collection of Foraminifera, now in the British Museum (Natural History). The method is admirably adapted for its purpose, and, although rather expensive, it can be used without trouble if all the specimens can be mounted on slides of only one or two standard sizes. The Polyzoa do not satisfy this requirement, and it is not only expensive to keep a sufficient stock of sizes of the sheath, but it involves waste of time in finding one which fits a particular slide.

The new method I have to suggest is the use of a bandage of "cellophane," slightly wider than the hole in the slide and of such a length that its two ends overlap on the back of the slide, where they are held in position by a slip of a gummed label. It is a simple modification of the use of this material in shops for the protection of objects from dust or handling. The method is applicable to slides of any width or thickness, the cellophane, which is strong and not easily torn, costing next to nothing and taking little time to place in position. When there it is so transparent (even if slightly crumpled) that the object can be studied through it in the great majority of cases. If the specimen requires an unobstructed view, or is found to rquire further cleaning or other treatment, the bandage may be slipped along the slide to either end and be brought back to its original position without injury; or, if necessary, it can be replaced by a new bandage, which costs no appreciable amount of money or time.

Dr. Alexander Scott, F.R.S., Director of the Research Laboratory in the British Museum (Bloomsbury), has kindly informed me that cellophane is practically regenerated cellulose, not of the "celluloid" type and containing no "nitro-" group, and that it can therefore be expected to remain unaltered, without losing its transparency, for a reasonably long time. I may add that I have shown my method to several experienced curators, all of whom have expressed favourable opinions with regard to its use for the purpose indicated.

July 13, 1934.

THE ANNALS

AND

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[TENTH SERIES.]

No. 81. SEPTEMBER 1934.

XXIX.—*The Percy Sladen and Godman Trusts Expedition to the Islands in the Gulf of Guinea, October 1932–March 1933.*—II. *Diptera Nematocera.* By F. W. Edwards, M.A., Sc.D.

The Dipterous fauna of the islands of the Gulf of Guinea has remained until now almost unknown. Among the Nematocera, so far as I am aware, only one species (*Obliogaster flavicoxa* Edw.) has been recorded in print as occurring on the island of São Thomé, although a few additional records are to be found in the files of the Imperial Institute of Entomology, based on small collections made by Messrs. H. J. Snell, H. P. Thomasset, and F. W. Urich. The collection of Diptera made by Mr. Tams, though far from complete, is therefore of great interest. As a result of the study of this material, the following points appear to be brought out :—

1. The fauna is of purely Ethiopian type, without any admixture of Neotropical forms.

2. Although the species are very similar to those of the adjoining African mainland, many if not most of them show an appreciable degree of differentiation, especially those occurring at the higher altitudes.

3. The occurrence of two species of *Conosia*, one on Principe and one on São Thomé, indicates that some

degree of "island endemicity" may occur, but the material is too scanty for the formation of a definite conclusion on this point.

4. There are several cases in which the species of these islands appear to be more closely allied to those occurring on the islands of the Indian Ocean than to any yet known on the African mainland.

Mycetophilidæ.

Macrocera puncticosta, sp. n.

♂.—*Head* ochreous, with the usual dark ocellar spot. Antennæ over three times as long as body, first five or six segments uniformly pale, rest gradually darkened. Palpi dark. *Thorax* ochreous; mesonotum without definite markings except for a small blackish spot above root of each wing; lower part of sternopleura and posterior part of pleurotergite dark. *Abdomen* mainly ochreous, with narrow dark apical bands on segments 2–4. *Legs* with coxæ uniformly ochreous; femora and tibiæ narrowly dark at tips. *Wings* broad, mainly clear, costal and marginal cells rather bright yellow; a narrow blackish band at base, chiefly formed by short streaks on the veins and folds; four blackish marks on costa, situated at tips of veins *Sc*, *R* 1, *R* 4, and *R* 5, the fourth much the largest; a brown patch, bordered with darker, fills base of cell *M* 3 and is more or less connected above with the first two costal spots, also extends downwards across cell *Cu* 2 near its base. Membrane without macrotrichia. Vein *Sc* ending above outer end of basal cell; *R* 1 somewhat thickened at tip; *R* 4 very oblique. Halteres with blackish knob. Wing-length 6 mm.

São Thomé, 1 ♂.

This is related to the Oriental *M. alternata* Brun. and *M. ephemeræformis* Alex., which have very similar wing-markings, but differ in the ringed antennæ and much longer subcostal vein. Single female specimens of *M. puncticosta* or of closely related species are in the British Museum from Sierra Leone, Gold Coast, and Nyasaland.

In *M. puncticosta*, as well as in many other species of *Macrocera* (though not in *M. alternata* or *M. ephemeræformis*), there is a dark streak in the marginal cell (cell *R* 1) arising from a little beyond the middle of *Rs* and extending longitudinally for a variable distance, in some species almost reaching the costa slightly beyond the tip of *R* 1. If my interpretation of the radial venation of the Mycetophilidæ is correct, this streak lies along the course formerly occupied by the lost vein *R* 2+3, and may therefore, perhaps, be regarded as a vestige of that vein, such as one might expect to find in one of the more primitive genera of the family.

Mycomyia sp.

São Thomé, 1 ♀.

A rather distinct species, with vein *Sc* ending in *R*, costa ending abruptly at tip of *R* 5, a dark cloud over the small cell, whole wing-tip faintly darkened, and knob of halteres blackish. Very similar specimens (also ♀) are in the British Museum from Belgian Congo and Cape Province, S. Africa; as the structure of the ♂ hypopygium is of such importance in this genus, it is not advisable to name the species from the ♀ alone.

Leia thomensis, sp. n.

♀.—*Head* mostly blackish above, face ochreous. Antennæ with scape ochreous, flagellum blackish except on underside of first few segments. Palpi yellow. *Thorax* with mesonotum shining black except on anterior fourth, which is yellow; scutellum yellow; postnotum and pleurotergites black; pleuræ mostly yellowish, with upper part of pteropleura black, covered (except on lower part of sternopleura) with silvery dusting, most noticeable when seen from above. Four long scutellar bristles. Posterior half of mesonotum largely bare, but with a pair of very long prescutellar bristles. *Abdomen* black above, yellow beneath; ovipositor white. *Legs* with all coxæ pale yellowish, femora and tibiæ brownish yellow, with black bristles and dark spurs; middle and hind femora with a dark streak above (not beneath) on basal half or more; hind femora with tip only very narrowly dark. Front tibia with a ventral bristle before middle. *Wings* greyish, with distal third darker, but not conspicuously so; no other markings. Branches of median fork parallel; *Cu* 1 very narrowly interrupted at base and ending well before wing-margin. Halteres yellow. Wing-length 4 mm.

São Thomé, 4 ♀♀.

This species belongs to the same group as *L. notabilis* Edw., which includes several African species. The colouring of the thorax of *L. thome* is *nsis*distinctive.

Exechia silhouttensis Edw., var. ?

São Thomé, 1 ♀.

A species with a conspicuous silvery margin to the mesonotum, first recorded from the Seychelles Is., but since found in Uganda. Only females are known.

Mycetophila lineola Mg., var. ?

São Thomé, 1 ♂, 1 ♀.

A very widely-distributed species in Europe, Africa, and Asia.

Rhyphidæ.

Anisopus dibaphus, sp. n.

Closely related to *A. annulicornis* Edw. of Africa, which it resembles in wing-markings and in having segments 5, 6, 9, and 10 of the antennal flagellum pale yellow, 15 white, 4, 7, 8, and 11–14 black. Differs from *A. annulicornis* as follows :—Segments 2 and 3 of antennal flagellum all black (instead of brownish on upper side only), 1 black above. Front coxæ each with a round, dark brown spot in front near base (absent in *A. annulicornis*). Hind legs differently coloured in the two sexes : in ♂ femur largely black, narrowly yellow at base and with a yellow subterminal ring, tibiæ similarly coloured but yellow subterminal ring obsolete, first tarsal segment narrowly yellow at base only ; in ♀ (as in both sexes of *A. annulicornis*) femur, tibia, and first tarsal segment each yellowish with only the tip blackened. Wings much less hairy, with macrotrichia more or less confined to distal half, especially in ♂ (in *A. annulicornis* the whole membrane is hairy in both sexes). Hypopygium of ♂ showing small specific differences.

São Thomé, 3 ♂♂, 20 ♀♀, mostly taken around latrine.

The sexual difference in the colour of the hind legs is surprising, as it is not found in any of the other species of this group ; in the Oriental region species are found with one or other type of colouring in both sexes. Males of *Anisopus* are, however, commonly darker than females, and in *A. annulicornis*, as in *A. dibaphus*, the halteres are blackish in the male, yellow in the female.

When describing *A. annulicornis* I stated that the upper facets of the eyes of the ♂ are not enlarged. A re-examination of a paratype ♂ in the British Museum shows that this is not strictly correct; the upper facets, though much less enlarged than in *A. pulchricornis*, are still slightly larger than the lower ones. This is also the case in *R. dibaphus*.

Olbiogaster flavicoxa Edw.

This species, described from a single male collected by Mr. H. J. Snell in 1919–21, was not found again by Mr. Tams.

Psychodidæ.

Telmatoscopus sp. ?

São Thomé, 1 ♂ (antennæ broken).

Telmatoscopus albipunctatus Will.

Principé, 16 ♂♀.

Culicidæ.

Dixinæ.

Dixa varipes, sp. n.

♂.—*Head* dark brown above; clypeus short and black; palpi black. Antennæ with scape and base of first flagellar segment yellow, latter segment distinctly thickened, remainder all slender. *Thorax* with yellowish ground-colour; mesonotum with three separate brownish stripes, median stripe continued backwards as a thin dark ine which crosses the scutellum. Pleuræ with indefinite dark mottling; no sternopleural hairs. *Abdomen* dark brown. *Legs* with front coxæ darkened, posterior coxæ pale; front and middle femora yellowish, with black tip and with a broad dark area beyond middle; hind femora yellowish, with only the tip blackish; front and middle tibiæ dark, narrowly yellowish at base; hind tibiæ yellowish with the tip dark and a broad dark area before middle; front and middle tarsi with first segment yellowish; hind tarsi almost all dark, first segment without long hairs at base beneath. *Wings* nearly clear, with a slight dark cloud over cross-veins, continued faintly along vein *Cu* 2; costal and subcostal veins yellowish. Fork-cells short, distinctly shorter than thin stems. Vein *Sc* ending well before base of *Rs*; *M* with macrotrichia for the greater part of its length. Wing-length about 3 mm.

São Thomé, 1 ♂.

This is quite distinct from any described African species, the colouring of the legs and scutellum being unusual.

CULICINÆ.

A small collection of mosquitos was made on São Thomé by Messrs. Snell and Thomasset in 1919–21, and included the following species:—*Anopheles gambiæ* Giles, *Culex fatigans* Wied., *C. thalassius* Theo., *C. decens* Theo., *C. nebulosus* Theo.

Mr. Tams's collection includes the following:—

Anopheles gambiæ Giles.

São Thomé, in house at Cable station at night.

Uranotænia micromeles, sp. n.

A dark species with no obvious ornamentation; rather large for a member of this genus, wing-length 2·7–3 mm.

Head clothed with flat black scales, with a narrow border of white round eyes; numerous black upright scales on dorsal surface. Palpi and proboscis blackish. *Thorax* with integument mainly dark brown, including most of pleuræ, but pleural sutures, meron, and lower part of sternopleuræ lighter; a small blackish area immediately above and in front of wing-root. Mesonotum with numerous long dark bristles, and narrow dark scales; a few narrow whitish scales on lateral margin immediately in front of the pre-alar black patch. Sternopleura with a small patch of dull whitish scales in middle; pleural chætotaxy normal, lower mesepimeral bristle rather strong and dark; about four upper sternopleuræ. *Abdomen* dark above, rather lighter beneath. *Legs* dark, including tarsi; no unusual features in ♂. *Wings* with normal venation; scales all dark, moderately broad.

São Thomé, 15–21. xi. 32, 5 ♂♂, 19 ♀♀, reared from pupæ found in shaded stone trough fed by a small spring at 4000 ft., bottom of water with layer of dead leaves.

Differs from *U. inornata* Theo. in the presence of a blackish spot in front of wing-root, and of whitish scales in front of this spot; from *U. mashonaensis* Theo. in the general darker colour (especially of the pleuræ), and in having the black prealar spot smaller and less sharply defined.

Aëdes (*Stegomyia*) *ægypti* Linn.

Principé: Anno Bon.

Aëdes (*Aëdimorphus*) *nigricephalus* Theo.

São Thomé, caught in house at Cable station at night.

Eretmopodites chrysogaster Graham.

Principé.

Culex fatigans Wied.

São Thomé, in house at Cable Station at night.

Culex tamsi, sp. n.

A species of the *pipiens* group, closely resembling several others occurring in East Africa (*trifilatus*, *andersoni*, *vansomereni*, etc.), and agreeing with these species in having the proboscis entirely black, thorax dark, abdominal tergites with creamy-white basal bands, sternites with black apical bands which are produced towards the base in the middle, and tibiæ with conspicuous creamy spots at the tips.

Palpi of ♂ scarcely longer than proboscis and almost bare, with few or no long hairs on the last two segments; a narrow white ring in middle of long segment. Thorax (♂♀) with the light scales rather bright golden in tint, not forming a very definite pattern, but aggregated in lateral and median areas in front and in a pair of ill-defined spots in middle (much as in *C. vansomereni* Edw.). Hind femora (as in *C. andersoni*) almost entirely black-scaled on anterior surface, with a short pale area at base beneath and on posterior surface. *Hypopygium* of ♂ with basal parts (phallosome and paraprocts) almost exactly as in *C. trifilatus* Edw., but differing in the form of the bristles on the subapical lobe of the coxite; in both species these are in two groups of three, but whereas in *C. trifilatus* two in one group and one in the other are thickened and hooked at the tip, in *C. tamsi* all six are slender and simple.

São Thomé, 15–21. xi. 32, 40 ♂♂, 7 ♀♀, reared from larvæ and pupæ found in company with those of *Chanotænia micromelas.*

Several larvæ were preserved; they closely resemble *C. pipiens* and *C. andersoni.*

Ceratopogonidæ.

The following determinations have been made by Dr. J. W. S. Macfie.

Forcipomyia ingrami Carter.

São Thomé, 1 ♂, 1 ♀.

Forcipomyia inornatipennis (Aust.) var. *ornaticrus* I. & M.

São Thomé, 2 ♀♀.

Atrichopogon ? *africanus* I. & M.

São Thomé, 1 ♀.

Culicoides austeni C. I. & M.

São Thomé, 1 ♂, 1 ♀. This is apparently the species regarded by Gil Collado as *C. hostilissimus* (Pittaluga) and described from specimens from Fernando Po in Bull. Soc. Path. Exot. xxiv. pp. 672–677.

Culicoides distinctipennis Austen.

São Thomé, 1 ♀.

Culicoides citroneus C. I. & M.

São Thomé, 23 ♀♀.

Culicoides grahami Austen.

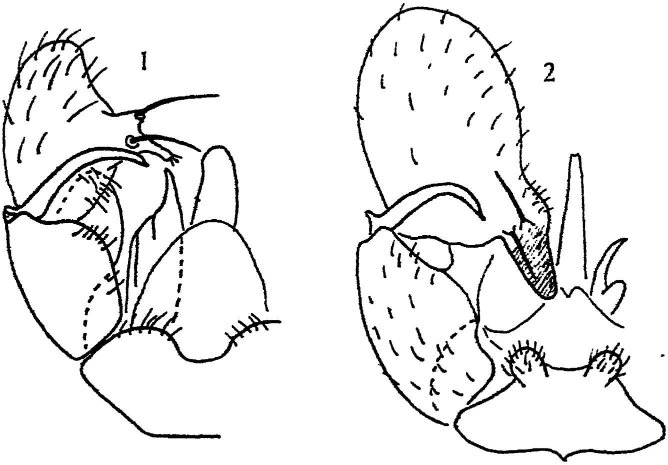
São Thomé, 1 ♂.

Tipulidæ.

Limonia (*Dicranomyia*) *tamsi*, sp. n.

Belongs to the same group as *D. tipulipes* Karsch and related species, but rather well distinguished by the two dark dots in the second anal cell.

Head dark greyish, including antennæ and mouth-parts. Front narrow, scarcely as wide as two facets. Segments of antennal flagellum rather shortly oval, last segment scarcely longer than the rest, verticils short. Palpi well developed. *Thorax* dark greyish brown, rather heavily pruinose, mesonotum without distinct stripes; pleuræ with a rather broad but indefinite darker median longitudinal stripe. Sternopleura with numerous short hairs. Pronotum small. *Abdomen* blackish, genital segments of both sexes light brownish. Hypopygium of ♂ with two long spines on rostrum, placed rather far apart (fig. 1). *Legs* slender, brownish, femora with a narrow and ill-defined pre-apical ring. Claws with basal tooth. *Wings* greyish brown, with small but distinct dark grey clouds at base and tip of *Rs* (that at base of *Rs* including tip of *Sc*) and at stigma; dark grey seams over cross-veins, along middle third of vein *R* 1, and at tips of *R* 2+3 and *Cu*; two rather conspicuous dark grey spots in second anal cell, one near the base (at the point where *Ax* diverges from *An*), the other close before tip of *Ax* and in contact with this vein; the second spot sometimes includes traces of a stump-vein. Venation:



Hypopygium of ♂, dorsal view, of *Limonia* (*Dicranomyia*) *tamsi*, sp. n. (1), and *L.* (*D.*) *snelli*, sp. n. (2).

Sc extending almost to level of middle of *Rs*, but latter short, very little longer than basal section of *R* 4+5; discal cell rather long and narrow; *m–cu* at its base; *r–m* short.

São Thomé, x.–xi. 1932, 19 ♂♂, 15 ♀♀.

This species is quite distinct from any known to me by specimens or description from the mainland of Africa, but a male in the British Museum from Mauritius is very similar indeed, and is either conspecific or belongs to a representative species.

Limonia (*Dicranomyia*) *snelli*, sp. n.

Belongs to the same group as *L. tamsi*; distinguished by wing-markings and structure of ♂ hypopygium.

Head much as in *L. tamsi*, but flagellar segments more rounded. *Thorax* darker than in *L. tamsi*; mesonotum as seen from in front with three blackish-brown stripes, median stripe broad and conspicuous. Pleuræ almost uniformly dark. *Abdomen* with hind margins of segments narrowly pale. Hypopygium of ♂ (fig. 2) with tergite of rather peculiar form; rostrum thick and dark, the two spines at its base pointing in opposite directions, one lying in close contact with rostrum (in all 4 ♂♂ examined). *Legs* stouter than in *L. tamsi*. *Wings* with four rather large dark brown spots on costal border, one at base, on over middle of *R*, one over base of *Rs* and including tip of *Sc*, the fourth forming the stigma; no spots in second anal cell; slight dark clouds over cross-veins and tips of veins *R* 2+3 and *Ax*; veins dark, except that *C*, *Sc*, and *R* 1 are yellow between the dark spots. Venation: *Sc* ending opposite or slightly beyond middle of *Rs*, which is of moderate length and almost straight, nearly twice as long as basal section of *R* 4+5. Discal cell smaller than in *L. tamsi*, but still rather narrow; *m–cu* at its base.

São Thomé, x.–xi. 1932, 2 ♂♂, 2 ♀♀; also 1919–21, 3 ♂♂ (*H. J. Snell*).

The specimens collected by Mr. Snell were placed in the British Museum Collection among the series of *L. tipulipes*, but this determination was certainly incorrect.

Limonia (*Arhipidia*) *pallidipes* Alex. ? (*miosema* Speiser ?).

São Thomé, 1 ♀.

Limonia (*Thrypticomyia*) *seychellarum* Edw.

São Thomé, 2 ♂♂, 3 ♀♀.

Specimens apparently referable to this species (rather than to *nigeriensis* Alex.) have recently been received from Sierra Leone (*D. J. Lewis*); the species is evidently very widely distributed, though at present no other records are available from the African mainland.

The São Thomé specimens differ slightly from those from the Seychelles Is. in the rather less extensively white-tipped tarsi, having fully the basal half, instead of only about the basal fifth, of the first tarsal segment dark; even the Seychelles specimens, however, exhibit variation in this respect, and there is no doubt the species is the same, the male hypopygium being identical and distinctive (the various representative forms occurring in the Oriental and Australasian regions differ very obviously in the structure of this organ).

Mr. Tams's notes confirm what was already known of the habits of this species. He writes:—"The tight-rope dancer! Tipulid remarkable for its habit of dancing on a line (web) sometimes 4 abreast. At this date have not discovered origin of line."

Limonia (*Limonia*) *rhizosema* Speiser, var. ?

São Thomé, 4 ♂♂, 4 ♀♀.

These specimens agree with examples in the British Museum from the Seychelles Is. in having the antennal flagellum all black and a subterminal black ring on the femora; they differ chiefly in having the dark markings of the thorax less extensive, the scutellum being entirely or almost entirely yellowish. The South African *L. subapicalis* Alex. (*capensis* Alex.) differs rather more noticeably in having the antennal flagellum mainly yellowish, black only at the base and tip. In both these species the ♂ hypopygium has a very similar structure, resembling that of many species of the Oriental subgenus *Libnotes.*

Limonia (*Limonia*) *mahensis* Edw. ?

São Thomé, 1 ♀.

The specimen does not differ obviously from the types from the Seychellis, but in the absence of a ♂ the determination is uncertain. I am not acquainted with a continental African species which this specimen resembles so closely as it does *L. mahensis*.

Styringomyia annulipes Edw., var.

São Thomé, 1 ♂.

This is not the West African var. *occidentalis* Edw. (which is perhaps more properly regarded as a distinct species from *S. annulipes*), but is much more like typical specimens of *S. annulipes* in the British Museum from the Seychelles Is. It differs from these latter in having the black dots on the wing fainter, and very slightly in the form of the inner appendages of the hypopygium.

Trentepohlia (*Trentepohlia*) *speiseri* Edw.

Principé, 2 ♀♀.

Trentepohlia (*Trentepohlia*) *tripunctata*, sp. n.

Head dark above; proboscis and palpi yellow; antennæ blackish, base of flagellum more brownish. *Thorax* and *abdomen* wholly light yellow. *Legs* yellow; tips of femora narrowly but conspicuously blackened; tips of tibiæ and the whole tarsi darkened. No femoral spines (front legs missing). *Wings* nearly clear, veins nearly all yellow; a black spot over *R* 2, another over fork of *Rs*, and a third near base of vein *Ax*; cross-veins also narrowly bordered with black. Halteres yellow. Wing-length 7 mm.

São Thomé, 1 ♀.

A distinctively-coloured species, which has more resemblance to the Oriental *T. mcgregori* Alex. than to any other described species, but is quite distinct.

Ceratocheilus seychellarum Edw., var. ?

São Thomé, Lagoa Amelia, 18. xi. 32, 1 ♂.

The specimen is darker than the types from the Seychelles Is., and has vein *R* 2 rather longer, but is otherwise extremely similar. The species differs from other known Ethiopian forms in having the dark markings of the wings confined to a cloud over the base of vein *R* 2 and a seam over the cross-veins—no darkening at tips of veins or at the bend of vein *An*. Although not hitherto recorded from continental Africa, some specimens in the British Museum from Elisabethville, Belgian Congo, are probably conspecific.

Ceratocheilus gilesi Edw.

Principé, 1 ♂.

A widely distributed West African species.

Ceratocheilus cornigerum Speiser.

Fernando Po, Mioko, near Moka, 1. ii. 33, one damaged specimen, rather larger than usual, with more strongly-marked wings.

Conosia principalis, sp. n.

♂.—*Head* dull yellowish brown; antennæ with the scape and basal flagellar segment blackish, remainder light brown. *Thorax* light yellowish brown, with a few dark dots faintly indicated on the præscutal interspaces, otherwise unmarked; form of mesonotum as usual in this genus. *Abdomen* light yellowish brown, unmarked. *Legs* wholly yellowish (but front pair missing). *Wings* with pale yellowish ground-colour, with numerous tiny dark dots rather regularly placed along all the veins, but practically none in the cells; larger (but not very large) and darker spots on costa opposite base of *Rs*, at stigma, tip of *R* 2+3, lower half of *m–cu*, and tip of *Ax*. Costal cell slightly widened before middle, but hind margin evenly rounded (not expanded at tip of *Ax*, as in ♂ of *C. irrorata*). Venation normal; cross-vein *r* oblique and curved; *R* 2 moderately long, turned up at tip; *r–m* immediately before end of discal cell. Halteres yellow. Length of body 14 mm.; wing 10·5 mm.

Principé, 10. xii. 32, ♂.

This apparently has much resemblance to *C. malagasya* Alex. of Madagascar, differing in the absence of a dark seam on vein *R* 2 and other details.

Conosia thomensis, sp. n.

♂.—Allied to *C. principalis*, which it resembles in many respects, differing as follows:—*Thorax* somewhat darker, but quite unmarked. *Abdomen* relatively shorter, with the basal two-thirds of each segment dark brown, distal third ochreous-brown. *Wings* with the dark spots less numerous but much larger (as well as less regular) and occupying a large part of the surface of the wing. Costal cell scarcely widened in middle. Cross-vein *r* straighter. Halteres with knob darkened. Length of body 10 mm., wing 8·5 mm.

São Thomé, near Roça Zampalma, 26. xi. 32, 1 ♂.

Erioptera (s. str.) *genualis*, sp. n.

Head whitish above; eyes widely separated in both sexes. Palpi and scape of antennæ black, first four flagellar segments whitish yellow; remainder dark brown. *Thorax* and *abdomen* pale brownish, pleuræ somewhat dusted with grey. Hypopygium of ♂ with outer style rather broad, with blackened and slightly hooked tip; inner style of peculiar form, projecting inwards to an acute elbow, then suddenly reflexed, distal portion forming a long straight spine directed caudally. *Legs* light brownish, knees abruptly white, this colour embracing an equal extent of tips of femora and bases of tibiæ. *Wings* quite unmarked; venation normal for the subgenus, except that vein *Cu* is rather strongly bent forwards at the tip. Halteres yellow. Wing-length 4–4·5 mm.

São Thomé, xi. 1932, 10 ♂♂, 4 ♀♀, at light.

This is quite distinct from any described African species, but is very similar to the Oriental *E. javanensis* de Meij.; the latter differs in having the tips as well as the bases of the tibiæ conspicuously white and in having vein *Cu* straight.

Adelphomyia polysticta, sp. n.

♂.—*Head* dark brownish, heavily pruinose with greyish brown. Antennæ with scape light brownish, first two flagellar segments thickened and yellow, rest slender and blackish. Palpi blackish. *Thorax* almost uniformly light reddish brown, pleuræ for the most part indefinitely darker; mesonotum slightly shining. *Abdomen* dark brown, posterior margins of tergites and hypopygium ochreous. *Legs* pale brownish, femora with a conspicuous narrow blackish subterminal ring, tips of tibiæ narrowly darkened, terminal tarsal segments blackish. *Wings* with yellowish ground-colour, with a dark grey band at base from vein *R* 1 to hind margin; a large dark grey spot over base of *Rs*, broad dark seams over the cord and apex of discal cell, and a dark cloud at the tip of each vein, the largest on vein *Ax*. Cell *M* 1 absent; veins *Cu*, *An*, and *Ax* rather strongly curved down at tip. Halteres yellow. Wing-length 7 mm.

São Thomé, 6. xi. 32, 1 ♂.

This is strikingly distinct in its wing-markings from the two known African species, but considerably resembles certain Oriental species, such as *A. nebulosus* (de Meij.), differing in the absence of cell *M* 1.

Nephrotoma angustifrons, sp. n.

♂.—*Head* dull brownish orange, with a narrow blackish median triangle on occiput and a small blackish area adjoining each eye. Front narrower than usual in this genus, at its narrowest point, as seen from above, distinctly less than half as wide as one eye; frontal tubercle only very slightly developed, much smaller than usual. Antennæ over half as long as body, mainly yellowish, first six flagellar segments narrowly darkened at base, last five darker, 2–6 with slight basal enlargement. Rostrum wholly light brownish. *Thorax* wholly shining, brownish ochreous; præscutal stripes evidently variable in development, in one specimen the stripes are mainly brown, with their outer edges narrowly black anteriorly, in the other the blackened area is more extensive but the median stripe remains divided, pronotum, scutellum, and postnotum brownish ochreous, unmarked; a narrow black lateral border to præscutum and scutum; sternopleura and mesepisternum darkened anteriorly. Scutellum (except at base) and postnotum (mediotergite) covered with a short, dense, blackish pubescence. *Abdomen* shining light brownish; tergite 2 with a pair of longitudinal blackish stripes, transversely interrupted in middle, and united on posterior border; tergites 3–5 broadly blackish in middle except towards base, the black area more or less divided in front; 6–8 largely dark. Hypopygium mainly yellowish; outer style moderately long and slender; sternite 8 prominent but without appendage, with a moderate amount of mixed black and yellow hair. *Legs* light brownish, tips of femora and tibiæ only narrowly and indistinctly darkened. *Wings* mainly clear; costal cell rather bright yellow; stigma dark brown, hairy. Discal cell rather small; cell *M* 1 sessile. Halteres with blackish knobs.

São Thomé, 2 ♂♂. A single ♀ from Principé perhaps belongs to an allied but distinct species.

N. angustifrons is fairly well distinguished from other members of the genus by details of coloration and by the narrow front and pubescent postnotum. I cannot indicate an African species which might be regarded as a close ally.

Tipula alphaspis Speiser, var. ?

Fernando Po, Misko, near Moka, 1 ♀.

Ctenacroscelis albovittatus Macq.

São Thomé, 1 ♀.

XXX.—*A new Characin Fish of the Genus* Vesicatrus *from British Guiana.* By J. R. Norman, Department of Zoology, British Museum (Nat. Hist.).

Among a large collection of fishes made by Dr. G. S. Carter, principally from the Mazaruni and Cuyuni Rivers, are two specimens of a small Characin fish, which is apparently new to science. The collection also includes examples of three species which were not mentioned by Eigenmann* in his important work on the freshwater fishes of British Guiana. These species, all from the Mazaruni River, are :—

Lycengraulis grossidens (Cuv.).
Eleotris pisonis (Gmel.).
Euctenogobius strigatus (O'Shaun.).

Vesicatrus carteri, sp. n. (Figs. A–C.)

Depth of body 2⅘ to nearly 3 in length, length of head 3¾ to 3⅘. Dorsal profile nearly straight from snout to dorsal fin ; ventral profile evenly curved. Snout shorter than eye, diameter of which is 2⅗ to 2⅔ in length of head, and greater than interorbital width. Maxillary extending to below anterior margin of pupil or not quite as far ; each præmaxillary with an outer series of two tricuspid teeth near the symphysis, and with or without a row of 2 to 4 conical teeth near its junction with the maxillary † ; an inner continuous series of 5 tricuspid and 2 to 4 conical teeth ; each maxillary with from 28 to 30 graduated conical teeth, extending along the greater part of its length ; lower jaw with 6 tricuspid teeth on each side of the symphysis, followed by a series of about 12 graduated conical teeth. Occipital process about four times in the distance from its base to origin of dorsal, bordered on each side by 3½ scales. 7 or 8 gill-rakers on lower part of anterior arch. Scales each with a few divergent striæ; 36 to 38 in a longitudinal series, 11 or 12 between origin of dorsal and root of pelvic; predorsal area bluntly keeled, with about 12 median scales; area in front of pelvics flattened, with two series of overlapping scales; a small scale in the angle between each of the middle pairs; caudal fin not scaled. Lateral line developed only on the first 9 or 10 scales. Dorsal 11; origin equidistant

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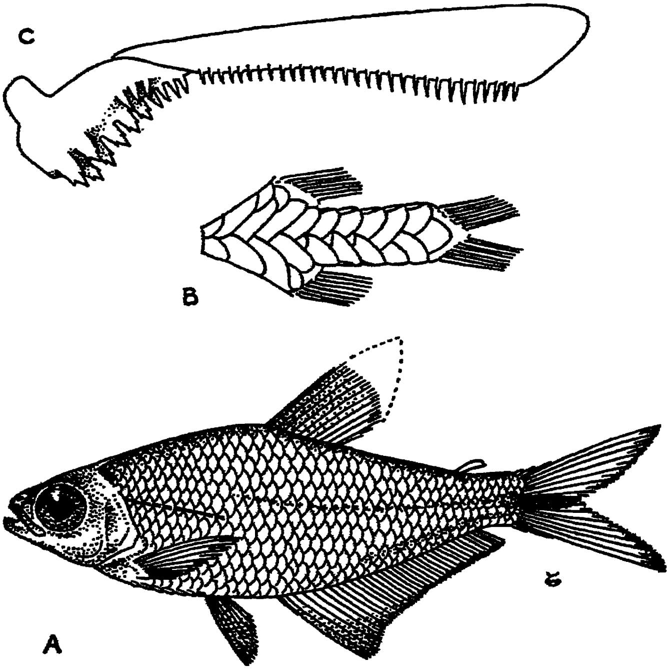
* Mem. Carnegie Mus. v. (1912).

† Apparently absent in the larger specimen.



Vesicatrus carteri, sp. n.

A. Lateral view of holotype (×2); B. Ventral surface of same specimen (× about 6); C. Dentition of upper jaw of paratype (greatly enlarged).

from tip of snout and base of caudal, nearly above that of anal. Anal 34–36 (31–33 branched rays); margin a little concave. Pectoral a little shorter than head, reaching beyond root of pelvic, which extends to a little beyond origin of anal. Silvery, with a number of minute dark dots on head, body, and fins; no humeral or caudal spots; middle rays of caudal more or less blackish *.

Described from two specimens, 37 and 44 mm. in total length, from a forest stream tributary to the Cuyuni River. The larger example is selected as the holotype.

The genus *Vesicatrus* is doubtfully distinct from *Phenacogaster*, differing solely in the incomplete lateral line. Only one other species is known, *V. tegatus* Eigenmann, from the Upper Paraguay Basin, which may be readily distinguished by its dentition and coloration.

XXXI.—*Notes on the Ephemeroptera of the Godman and Salvin Collection, with Descriptions of Two new Species.*

By D. E. Kimmins.

Since 1905, when it was presented to the British Museum, the Godman and Salvin collection of Central American Ephemeroptera has been kept separate from the main collection of Ephemeroptera. Recently it was decided to combine the two, and as Eaton, who worked this section of the 'Biologia Centrali-Americana,' did not fix the types of the various species described by him from this collection, this will be done in these notes. Wherever possible, the abdomen of the type has been removed and treated with KOH, and figures and descriptions of the genitalia have been made. These preparations have subsequently been mounted in Canada balsam between cover-glasses and reattached to their respective specimens. Eaton's figures and descriptions of these parts were made (in most, if not in all, cases in this work) from dried material, and the increase in the number of described species has rendered it difficult for workers without access to Eaton's types to identify with certainty some of his species. The following notes and figures are offered in the hope that at least some of these uncertainties may be cleared up Two new species are described in these notes, based on material to which Eaton applied only a generic name.

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* In one specimen (44 mm.) the caudal fin has a distinct black horizontal band, but in the other this band is very faint. Dr. Carter informs me that in life all the fins are tinged with orange.

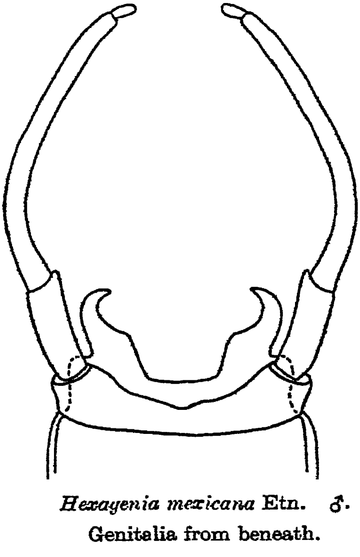
Family **Ephemeridæ.**

Hexagenia mexicana Etn.

Trans. Linn. Soc., Zool. ser. ii. vol. iii. p. 50 (1883); Biol. Centr.-Amer., Neur., Ephem. p. 5, pl. i. fig. 4 (1892).

The genitalia of the ♂ from Atoyac, Vera Cruz, are very well defined. The base of the forceps (fig. 1) is broadly excised and short. Forceps with the basal joint of moderate length, and with a small projection at the inner apical angle; the second joint long and curved; the third joint very small and ovate. Lobes of the penis widely separated, their apices hooked inwards. Between the bases of these hooks is a deep, rather angular excision, the basal margin of which is more strongly chitinized.

Fig. 1.



Hexagenia mexicana Etn. ♂.
Genitalia from beneath.

At the base of each hook on its external margin there arises a rounded process, or shoulder.

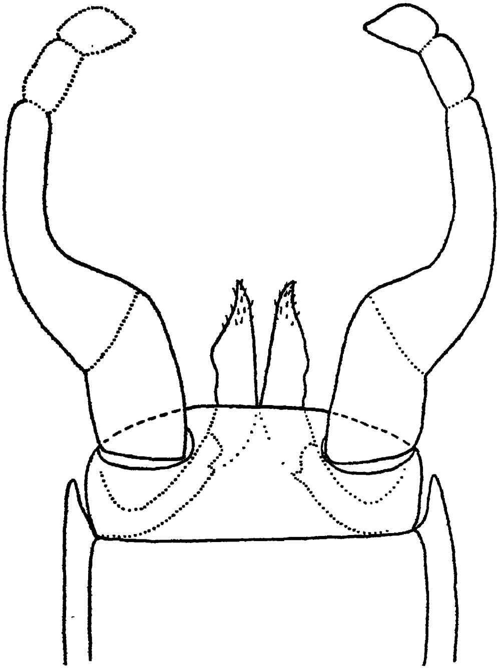
Family **Leptophlebiidæ.**

Choroterpes inornata Etn.

Biol. Centr.-Amer., Neur., Ephem. p. 6, pl. i. figs. 5, 5 *a–e* (1892).

The type-series in the British Museum now contains 9 ♂ imagines, 1 ♀ imago, and 2 ♂ subimagines. From these I have selected as *type* the ♂, from which one hind wing has been removed by Eaton and mounted dry between cover-glasses; the remainder have been marked as paratypes. There is a ♂ paratype from this series in the collection of Mr. J. McDunnough, of the Department of Agriculture, Ottawa. The 2 ♂ subimagines in the

Fig. 2.

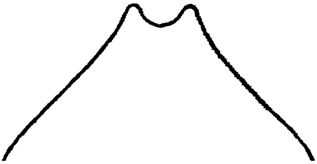


Choroterpes inornata Etn. ♂ (type).
Genitalia from beneath.

McLachlan collection, mentioned by Eaton, I have not seen.

The line of division between the two basal joints of the ♂ forceps (fig. 2) is rather obscure in a cleared example, and less definite than is shown in Eaton's figure, and the terminal joint is longer and more pointed. The apices of the lobes of the penis carry a few short hairs. Genital stimuli notched near their apices.

Fig. 3.



Choroterpes inornata Etn. ♀ (paratype).
Ventral lobe from beneath.

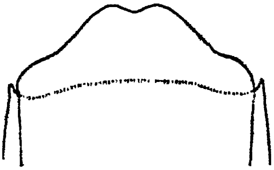
Ventral lobe of the ♀ (fig. 3) triangularly produced, its apex terminating in two small processes, with a semicircular excision between them.

Choroterpes nervosa Etn.

Biol. Centr.-Amer., Neur., Ephem. p. 6, pl. i. figs. 6, 6 *a* (1892).

The unique ♀ *type* has the left hind wing detached and mounted between cover-glasses. The anterior leg, described by Eaton, is now missing. Ventral lobe (fig. 4) produced in the centre, the sides somewhat sinuate, and the apex shallowly excised.

Fig. 4.



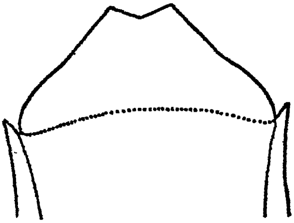
Choroterpes nervosa Etn. ♀ (type).
Ventral lobe from beneath.

Thraulus primanus Etn.

Biol. Centr.-Amer., Neur., Ephem. p. 7, pl. i. figs. 7, 7 *a* (1892).

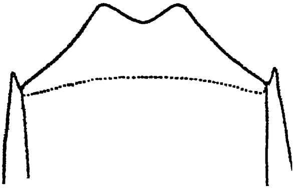
Both the ♂♂ have deteriorated in condition since Eaton's descriptions were made. The anterior and posterior legs, the setæ, and the apex of the abdomen are missing in both specimens. I have selected as the *type* the example in which the wings are better preserved. The ♀, which Eaton refers, with some doubt, to this species, lacks the left anterior wing and all legs but the left posterior. The ventral lobe (fig. 5) bears an obtusely-angled excision at its apex. The ♂ type and the ♀ have each one hind wing mounted between cover-glasses.

Fig. 5.



Thraulus ? primanus Etn. ♀.
Ventral lobe from beneath.

Fig. 6.



Thraulus versicolor Etn. ♀ (type).
Ventral lobe from beneath.

Thraulus versicolor Etn.

Biol. Centr.-Amer., Neur., Ephem. p. 7 (1892).

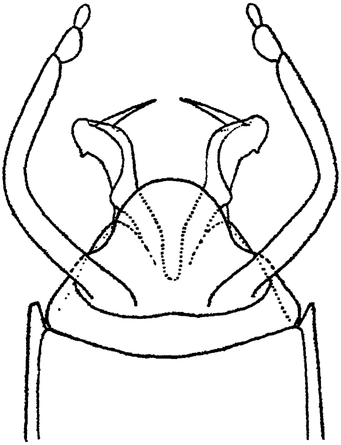
From Eaton's series of 4 ♀ imagines and 3 ♀ subimagines I have chosen as *type* the ♀ imago from Cache, Costa Rica, of which one hind wing has been mounted between cover-glasses. The specimen has both anterior legs, the right posterior leg, and one seta. The ventral lobe (fig. 6) terminates in two rounded apices, with a wide, somewhat obtusely angled excision between them. The lateral margins of the lobe are slightly concave.

Thraulodes (*Thraulus*) *lepidus* Etn.

Trans. Linn. Soc., Zool. ser. ii. vol. iii. p. 109 (1884) (*Thraulus*); Biol. Centr.-Amer., Neur., Ephem. p. 8 (1892); Ulmer, Arch. f. Naturg. lxxxv. A, 11, p. 34 (1920) (*Thraulodes*).

I have been unable to examine the *type* of this species, which is in the McLachlan collection, but I give a figure and description of the ♂ genitalia from one of the two ♂♂ mentioned by Eaton in the 'Biologia Centrali-Americana.' The terminal ventral segment (fig. 7) is produced above the bases of the forceps in a rounded, subtriangular lobe, whose sides have each a shallow excision at about midway from base to apex. Beneath the bases of the forceps there is a sinuous ridge, slightly produced centrally. Forceps each with the basal joint long and slender, bent to an obtuse angle about mid-way; second and third joints short, third shorter and much narrower than the second. Lobes of the penis divergent, their apices

Fig. 7.



Thraulodes lepidus Etn. ♂.
Genitalia from beneath.

rounded and turned more strongly outwards, and each bearing two spines. One, directed inwards and arising from the upper surface, is long and slender, and the other, on the outer lateral margin, is very small and directed basally. Beneath the penis-lobes is a pair of rounded plates. Ventral lobe of the ♀ scarcely different from that of *T. valens* Etn.

Fig. 8.

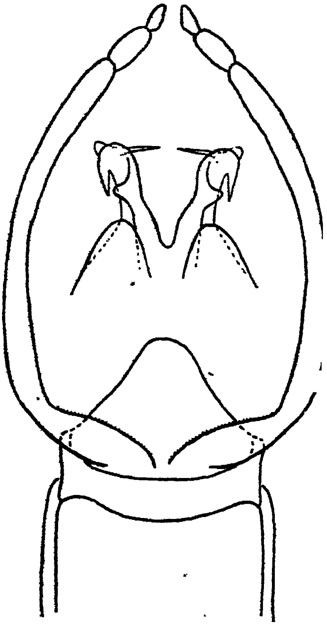
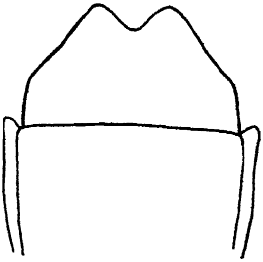


Fig. 9.



Thraulodes valens Etn. ♂♀ (paratypes).

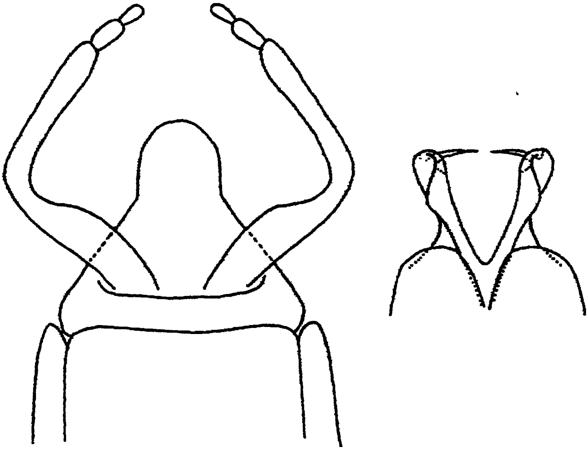
Fig. 8.—♂. Genitalia from beneath, lobes of the penis shown separately.
Fig. 9.—♀. Ventral lobe from beneath.

Thraulodes (*Thraulus*) *valens* Etn.

Biol. Centr.-Amer., Neur., Ephem. p. 9 (1892) (*Thraulus*); Ulmer, Arch. f. Naturg. lxxxv. A, 11, p. 34 (1920) (*Thraulodes*).

There are four specimens in the type-series, 1 ♂ and 1 ♀ from Boquete, 1 ♂ from Volcan de Chiriqui, and 1 subimago from Caldera. From these I select as *type* the ♂ from Boquete, which is well preserved, and lacks only one anterior and one posterior leg. Terminal ventral segment of the ♂ (fig. 8) produced above the bases of the forceps in an upturned triangular lobe, with a rounded apex; sides slightly concave. Basal joint of forceps long and slender, narrowed and abruptly angled near the base. Remaining two joints short, the third about one-half as long as the second. Lobes of the penis divergent, apices rounded and furnished each with two spines; one, the longer, directed inwards, and the other basally. At the base of the penis-lobes, on the lower surface, is a pair of rounded plates. Ventral lobe of the ♀ (fig. 9) produced to an excised apex, its lateral margins bent outwards, with an obtuse angle near base.

Fig. 10.



Thraulodes hilaris Etn. ♂ (type).
Genitalia from beneath, lobes of the penis shown separately.

Thraulodes (*Thraulus*) *hilaris* Etn.

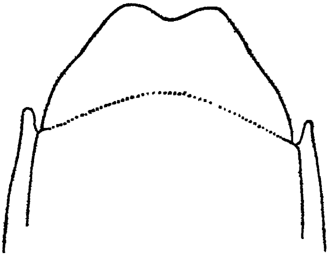
Biol. Centr.-Amer., Neur., Ephem. p. 9 (1892) (*Thraulus*); Ulmer, Arch. f. Naturg. lxxxv. A, 11, p. 34 (1920) (*Thraulodes*).

The type-series consists of 1 ♂, San Juan, Vera Paz, and 1 ♀, Teapa, Tabasco. The ♂, which I select as the *type*, has the right anterior leg missing. Terminal ventral segment of the ♂ (fig. 10) above the forceps triangularly produced, ending in an inverted U-shaped process. Basal joint of the forceps long, elbowed in the middle at about a right-angle; broadest at the base and tapering towards the elbow. Penis-lobes divergent, dilating slightly towards their rounded apices, each of which bear apparently but one spine, directed inwards. Beneath the penis-lobes, at their bases, are two rounded plates.

The ♀ lacks both anterior and one median leg, and all but a fragment of the setæ. Ventral lobe with an excision at its apex and sinuous lateral margins (fig. 11).

The three undetermined species of *Thraulus*, mentioned in 'Biologia Centrali-Americana' on p. 10, have the medius in the hind wing forked, and should, therefore, be transferred to *Thraulodes* Ulm.

Fig. 11.



Thraulodes hilaris Etn. ♀ (paratype).
Ventral lobe from beneath.

Family **Caenidæ.**

Tricorythodes (*Tricorythus*) *explicatus* Etn.

Biol. Centr.-Amer., Neur., Ephem. p. 11, pl. i. figs. 8, 8 *a* (1892) (*Tricorythus*); Ulmer, Arch. f. Naturg. lxxxv. A, 11, p. 51 (1920) (*Tricorythodes*); McDunnough, Canad. Ent. lxiii. pp. 267–8, pl. xviii. fig. 13 (1931).

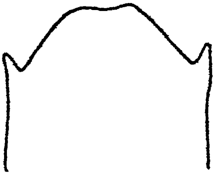
From the long series of this species I have marked as *type* the ♂ of which the left wing and legs have been mounted by Eaton between cover-glasses. 1 ♂ paratype is in the collection of Mr. J. McDunnough, Department of Agriculture. I am not figuring the ♂ genitalia, as Mr. McDunnough has already given an excellent drawing.

Leptohyphes brevissimus Etn.

Biol. Centr.-Amer., Neur., Ephem. p. 12, pl. i. fig. 9 (1892).

The three ♀ imagines in the type-series appear to be little changed since the time of their description. I have chosen as the *type* of the species the example of which a wing and legs are preserved between cover-glasses. The ventral lobe (fig. 12) is produced triangularly, with a broad, slightly emarginate apex. The specimen is very lightly chitinized and, after softening and clearing in KOH, I have been unable to make out the dividing-line between the lobe and the preceding segment.

Fig. 12.



Leptohyphes brevissimus Etn. ♀ (type).
Ventral lobe from beneath.

Family **Baëtidæ.**

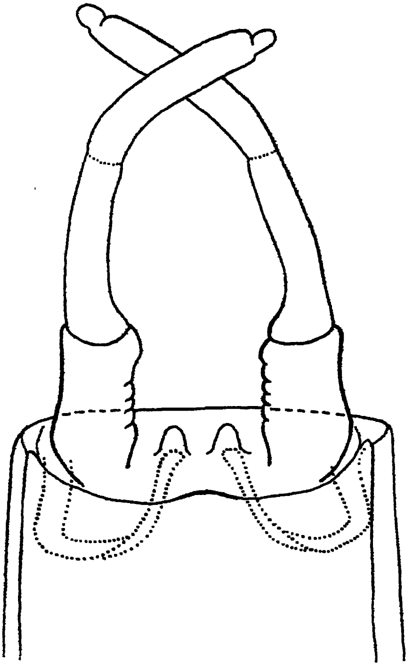
Baëtis salvini Etn.

Trans. Linn. Soc., Zool. ser. ii. vol. iii. p. 170, pl. xvi. fig. 29 *a* (1885); Biol. Centr.-Amer., Neur., Ephem. p. 13 (1892).

Eaton based his original description of this species on a ♂ imago and a ♀ subimago from Volcan de Irazu, Costa Rica, and says (p. 171) that the specimens are in the "Salvin and Godman Mus." They do not appear to be in the collection of Ephemeroptera presented to the British Museum by Messrs. Godman and Salvin, and I do not know where these types are to be found. The additional specimens listed by Eaton in the 'Biologia Centrali-Americana' (1 ♂, 3 ♀ imagines, 1 ♂ subimago) are in the British Museum, and I am refiguring and describing the genitalia of the ♂ from Panima, Guatemale.

Basal joint of the forceps (fig. 13) cylindrical, its inner side with four or five transverse wrinkles; second and third joints subequal, rather longer than the basal, and about one-half as wide; fourth joint small and ovate. Situated on the membrane between the basal joints of the forceps are two thin, lightly chitinized plates, rounded at their apices. Margin of the terminal ventral segment more strongly chitinized and pigmented at its centre. Internal hooks (? genital styles) very weakly chitinized and difficult to make out, but apparently sharply elbowed near their bases. The forceps appear more or less pigmented throughout.

Fig. 13.

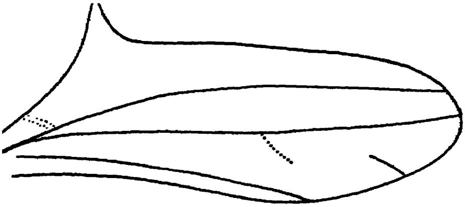


Baëtis salvini Etn. ♂.
Genitalia from beneath.

Under the heading of "*Baëtis* sp." is a long series from N. Sonora, Mexico. Treatment of a ♂ with KOH revealed well-defined genitalia which I was unable to reconcile with any North American species. Sketches of the

♂ genitalia and hind wing were submitted to Mr. J. McDunnough for his opinion. He replied that my species was very close to *B. quilleri* Dodds. This species was described from the ♀ sex only, and whilst agreeing in the large costal projection of the hind wing, differs somewhat in the shape of the wing and the arrangement of the veins. Unfortunately, one of the ♀ imagines only in the series possesses hind wings, but these appear to be similar to those of the ♂. I can discern no difference in the genitalia of the two species of *Baëtis* from N. Sonora listed by Eaton. I realise that it is quite possible that the species described below is really *quilleri* of Dodds, but I considered it preferable to risk creating a synonym rather than to cause possible confusion by figuring as *quilleri* an example the determination of which is doubtful.

Fig. 14.



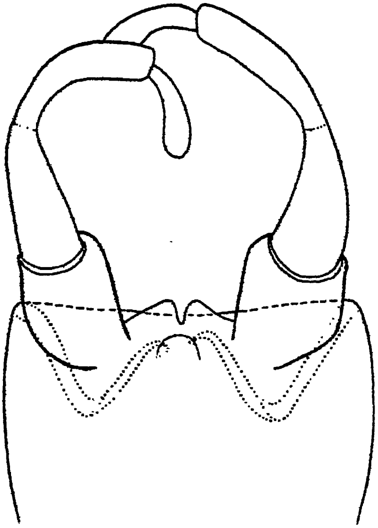
Baëtis eatoni, sp. n. ♂ (paratype).
Hind wing.

Baëtis eatoni, sp. n.

Eaton, Biol. Centr.-Amer., Neur., Ephem. p. 14 (1892) (*Baëtis* sp.).

♂ (dried).—Turbinate eyes black in the centre, reddish brown at the margins. Head and thorax shining dark brown. Abdomen brown, paler than the thorax, ventral segments slightly paler than dorsal; a darker, reddish-brown line along the lateral margins. Forceps and legs yellowish brown, setæ similar, with darker annulations. Wings hyaline, anterior wing with clear yellow-brown venation, cross-veins distinct; at the extreme base of the wing is a small brownish patch. Posterior wing (fig. 14) rather elongate, with a strong acute costal projection, which is sometimes folded over, giving the appearance of a stout, blunt, process. Three longitudinal veins, one (or sometimes two) intercalary vein between veins 2 and 3; vein 2 occasionally with the suggestion of a fork. Male forceps, after treatment with KOH (fig. 15), with the two basal joints brownish, and the remainder translucent whitish. No process on the inner apical margin of the basal joint; second joint rather longer than the basal, tapering; the third slightly longer than the second, and expanding towards its apex; fourth joint long, dilated at its apex. Margin of the ninth segment produced and excised in the centre. Between the bases of the forceps there is a small, rounded, raised plate.

Fig. 15.



Baëtis eatoni, sp. n. ♂ (paratype).
Genitalia from beneath.

Length of fore-wing, ♂ 5 mm.
Length of body, ♂ 4 mm.
Length of setæ, ♂ 6 mm.

The female resembles the male, but is more reddish brown in colour. Wings of the subimago fuscous.

Mexico, N. Sonora (*Morrison*), 17 ♂, 2 ♀ imagines, 9♂, 14 ♀ subimagines. Holotype, ♂, and paratypes, ♂♀, in the British Museum.

Family **Siphlonuridæ.**

Isonychia (*Chirotonetes*) sp.

Eaton, Biol. Centr.-Amer., Neur., Ephem. p. 16 (1892).

I have examined the genitalia of the only ♂ imago in this series; it does not appear to differ appreciably from McDunnough's figure of *Isonychia sicca* var. *manca* Etn. in Canad. Ent. lxiii. p. 158, 1931. The ♂ is larger than the dimensions given by Eaton for the ♀ of *manca*, and the cross-veins in the apical region of the fore-wing are dark brown as in other parts. The pterostigma is brown, and there is a brown spot at the origin of the branch from "vein 4" of Eaton. Owing to the scarcity of material, I am placing these examples provisionally as a variety of *I. sicca* Walsh.

Family **Ecdyonuridæ.**

The examples placed by Eaton as a genus allied to *Cinygma* I consider to belong to the genus *Heptagenia* as recently defined by Traver, and as I have been unable to reconcile it with any of the published descriptions of *Heptagenia* spp. I am describing it below.

Heptagenia salvini, sp. n.

Eaton, Biol. Centr.-Amer., Neur., Ephem. p. 16 (1892) (genus allied to *Cinygma*).

♂ imago (dried).—Head pale brown, eyes black; thorax brown, anterior lateral margins yellowish. Abdomen reddish brown, tergites with the posterior and lateral margins paler. Legs pale brown, apices of femora darker, almost piceous; anterior tarsi (fig. 16) with the joints decreasing in the following order:—2, 3, 4, 5, 1 (not 3, 2, 4, 5, 1 as stated by Eaton). The first tarsal joint is nearly one-third of the length of the second; tarsal claws dissimilar. Wings hyaline, with dark brown venation, pterostigma faintly yellowish brown. Genitalia (fig. 17): base of the forceps with a projection on each side. Apical joint of forceps damaged. Each main lobe of the penis appears trilobed at the apex, the division between the inner and middle lobes being deeper than that between the middle and outer. Three pairs of spines are present, the central pair moderately large, curved downwards, and slightly divergent. The second pair, situated on the lower surface near the apex, are slender and directed outwards. The third pair, which are much smaller, are placed on the apical margin.

Fig. 16.

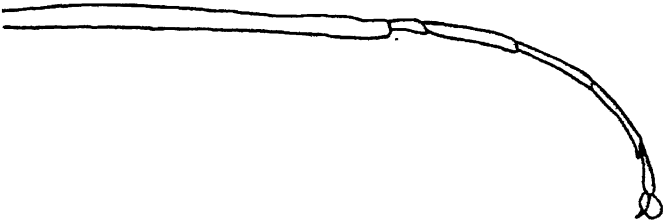
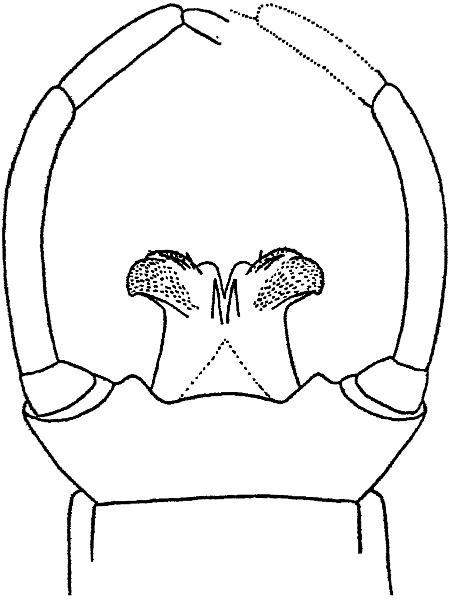


Fig. 17.



Heptagenia salvini, sp. n. ♂ (type).

Fig. 16.—Anterior tibia and tarsus.
Fig. 17.—Genitalia from beneath.

Subimago ♀ (dried).—Wing brownish, veins dark brown, cross-veins slightly shaded.

Length of fore-wing: ♂ imago 9 mm.; ♀ subimago 9–11 mm.

Type ♂ (with apex of abdomen and anterior leg mounted in balsam), 8 paratype ♀ subimagines, Mexico, N. Sonora (*Morrison*).

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XXXII.—*On* Lekanichthys howsei—*a new Dorypterid Fish from the Permian.*

By JAMES BROUGH, Department of Zoology, University of Manchester.

[Plate VIII.]

Introduction.

The family Dorypteridæ has, up to the present, contained only *Dorypterus*, a precocious and aberrant genus which presumably evolved from the Palæoniscidæ.

The new form, which I have named *Lekanichthys howsei*, displays many of the peculiarities of *Dorypterus*, and must be included in the same family. Although the stratum from which it was obtained has yielded fossil fishes for more than a century, the specimen here described is, to the best of my knowledge, unique. It is imperfect, but provides sufficient evidence to show that it differed from *Dorypterus* in a significant way.

Dorypterus is also rare, but has long been known from the Kupferschiefer of Germany and the Marl Slate of England, and a considerable literature has accumulated around it. The most comprehensive recent work on the subject is that of Gill (1927), who gave a very complete account of the genus, and dealt fully and critically with previous literature. Gill's account conflicts with those of the older authors in certain respects, but a personal examination of his material assures me that his interpretation of the structure is reasonable, and can be used for comparative purposes. The conclusions reached by Gill in considering the affinities of *Dorypterus* were that it was a highly specialized fish, derived from some branch of the Palæoniscidæ, which had acquired precociously characters which appeared much later in the main stock of bony fishes.

The new genus is of interest in that, in spite of the imperfection of the type-specimen, it shows clearly an intermediate grade of structure between the highly modified *Dorypterus* and the normal Palæoniscid.

The type-specimen was collected apparently many years ago, and has since lain in the Hancock Museum in Newcastle-on-Tyne. It was unlabelled when it came to my notice, and there is a little doubt as to the horizon from which it was obtained. The fossil and the matrix, however, both possess all the characteristics of the Marl Slate (Lower Permian), particularly as it occurs in the south of Durham County, and the specimen was probably obtained from this stratum in the Middridge-Thickley area. The only other reasonable possibility is that it is from the fish bed in the upper Magnesian Limestone at Fullwell, near Sunderland, but from a personal knowledge of both these strata I would suggest that it is almost certain to have been obtained from the Marl Slate. This bed has also yielded the only English specimens of *Dorypterus*.

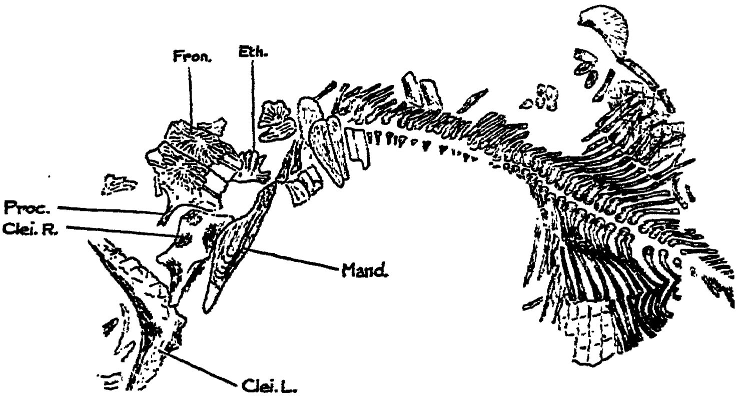
Description of Lekanichthys howsei, *gen. et sp. n.*

In the type-specimen the fins are not preserved, but part of the pectoral girdle is well displayed. The well-developed radials in the caudal region prove the presence of dorsal and ventral fins. There is no doubt that these were in much the same condition as those of other laterally compressed fishes, but while it is clear that the ventral fin extended forward to the anus, it is not possible to indicate the anterior limit of the dorsal fin.

The skull is disarticulated, but those elements which are recognizable are not far from their natural position. The vertebral column is, on the other hand, almost undisturbed, and much of the delicate scaly covering is preserved on the body. While it is clear that the fish had been macerated to some extent before fossilization, sufficiently to have detached the fins, it is doubtful if this process went far enough completely to disarticulate the skull had the latter been perfectly ossified. It is possible, therefore, that the skull was not completely ossified, and that the cranium and parts of the external covering were in a cartilaginous condition.

The general form of the fish is similar to that of *Dorypterus*. It is deep-bodied and laterally compressed, measuring approximately 270 mm. in length, and 110 mm. in depth immediately behind the abdominal cavity. The maximum depth is in the region of the abdominal cavity, and is probably a little in excess of the above figure.

Text-fig. 1.



Lekanichthys housei, gen. et sp. n.: drawn from the type-specimen. Natural size.

Clei.L., cleithrum of the left side, external view; *Clei.R.*, internal view of the lower part of the right cleithrum; *Eth.*, ethmoid; *Fron.*, frontal; *Mand.*, mandible; *Proc.*, process descending from the frontals toward the cheek.

Certain bones of the skull are thick and ganoine-covered. The ganoine layer is deeply incised to produce a well-defined ornament of ridges and tubercles, the ridges usually radiating away from centres of ossification. Other skull-bones are thin and smooth, and certain of the margins end in jagged edges which are very thin and appear to have adjoined unossified tracts.

The roof of the skull was covered by a bony shield which was composed essentially of the massive frontals, with smaller bony elements surrounding them. Certain of the latter were unornamented. The gross appearance of this shield in life must have been thickly rectangular, with two projecting processes, one on either side about the middle, and directed outward and downward towards the cheek. These processes are fragmentary, and it is impossible to say with any degree of certainty of which skull-bones they are composed. The anterior part of the shield was formed by a median ethmoid bone.

The frontals are stout and prominent, and are conspicuously ornamented. As they lie in the fossil they are rotated round so that their anterior ends are directed towards the body of the fish. They are somewhat elongated, being nearly three times as long as broad. The width is greater in the posterior half and the lateral margins are straight; but toward the anterior end they are slightly narrowed by a gentle excavation of the external border. The postero-lateral corners of these bones are produced into small semicircular projections. The full length of each bone is traversed by the supraorbital sensory canal, a prominent cylindrical cavity completely enclosed in the bone, and opening to the exterior by very minute pores. The appearance of these canals, and of the frontal bones generally, is strongly reminiscent of the condition in the Palæoniscidæ.

The ethmoid is a median element, about as broad as long, which adjoined the anterior margin of the frontals. It is of much more delicate construction than the latter, and is thin, smooth, and unornamented. The posterior border, that which adjoins the frontals, is straight and well defined; but the lateral and anterior margins are thin and jagged, and appear to have passed into unossified tracts. There is a moderately large excavation of the lateral border of this bone, which formed the dorsal margin of the nasal opening.

A large bony element is present which is determined as the mandible. There is little else that this bone could be, and it is identified partly by analogy with the mandible of *Dorypterus*, but mainly by the presence of a canal, taken as the mandibular sensory canal, which runs along its inferior border. The bone is acutely triangular; the superior border is straight over the greater part of its length, and displays no trace of dentition. The inferior margin is also straight, but is prolonged much further posteriorly than the upper border. The third side of the triangle is formed by the posterior margin, which runs obliquely forward. The articular portion of the jaw is thus in the form of an acute angle; the upper posterior angle is gently rounded. A wide sensory canal traverses the whole length of the bone in close proximity to the inferior margin.

Other cranial bones are preserved, but in such a condition that satisfactory determination is impossible.

The only relic of the appendicular skeleton consists of a pair of cleithra. That of the left side is well displayed and is a large, well-developed, and fairly thick bone, of not unusual appearance. It displays the general shape and proportions of the Palæoniscid cleithrum, and differs sharply from the peculiar element of that name in *Dorypterus*. The bone consists of two blade-like limbs, one projecting dorsally, the other anteriorly, the bases of which unite in the place where the pectoral fin articulated. The dorsal limb is larger and tapers to a point. The anterior border is straight, and is raised into a ridge at right-angles to the general plane of the bone; the posterior border is in the form of a slightly convex curve. The ventral limb is much smaller than the dorsal, but is similarly pointed. Both upper and lower margins are fairly straight and meet in a point anteriorly. The angle between the two limbs is about 120°. The region of the bone where the two blades meet is wide and thickened, and is marked posteriorly by a shallow concavity which indicates the position of the fin-articulation. The whole bone is smooth and unornamented.

A small, irregular piece of bony tissue underlying the cleithrum suggests that the primary shoulder-girdle was ossified, but the individual elements cannot be determined.

All flat-fish, whether dorso-ventrally or laterally compressed, require an extensive supporting framework in the plane of flattening. *Lekanichthys* was no exception to this rule, and the endoskeleton of the trunk and tail reached a high degree of development. There may be a correlation between the extensive development of endoskeleton and the reduced nature of the exoskeleton in this form. The contemporary Platysomids were equally deep-bodied, but the endoskeleton was much less extensively developed. These fishes had, however, a stout exoskeleton of interlocking ganoid scales, which probably provided the stiffening which was necessary in the vertical plane.

The bony internal framework of *Lekanichthys* extends from the dorsal to the ventral surface in the post-abdominal region : it consists of neural and hæmal arches and spines and internal radialia. The neural and hæmal arches and spines are large and well ossified, but true central ossifications were not developed. The notochord persisted, but was considerably constricted locally by ingrowths of the bases of the neural and hæmal arches. The neural arch consists of the roughly circular expanded base below and a rectangular piece above sloping backwards. At the lower part of the anterior border of this upper portion there is a blunt semi-circular projection which may have functioned as an articular process. The neural spines are long and delicate, narrowest in the middle, where they are more nearly circular in cross-section, but becoming broader and laterally flattened at either end.

There is a series of hæmal processes of moderate size above the abdominal cavity. They are smaller than the neural arches dorsal to them, and are triangular in shape. The broadened bases correspond to the expanded bases of the arches : they narrow and taper to a point ventrally. These processes unite in the caudal region to form the hæmal arches, which equal or slightly exceed the neural arches in size.

The hæmal arches are comparatively long, and, like the neural arches, are formed of an expanded basal portion and a more slender rod-like distal portion. The expanded bases approximate closely to the similar processes of the neural arches, leaving only a narrow passage between them.

The hæmal spines, present only in the caudal region, are very similar in size and shape to the neural spines. They are broad at the ends and constricted in the middle, more so than the neural spines but they display a similar posterior flexure.

There is a series of endoskeletal radialia attached to both neural and hæmal spines. The ventral series consists of elongated rectangular plates, perhaps a little broader than the head of the spine to which they are attached. Those near the tail-pedicle assume a very strong flexure.

The dorsal radialia are attached to the neural spines, and, like the ventral series, correspond in number with the elements of the vertebral column. The proximal portions of the dorsal radialia are very distinct, and are rectangular plates of about the same width as the spines with which they articulate. The distal ends are totally unlike those of the ventral series and appear to bifurcate, each element producing two distinct narrow processes. This condition is interesting when compared with that of *Dorypterus*.

It is clear that the exoskeleton had deteriocated, and that while the dorsal and ventral edges of the flattened plate-like body retained a covering of thin ganoid scales, the flank was essentially naked, and preserved only the relic of its former complete armour in a series of thin, delicate, and much-reduced scale-rows which are separated from one another by naked areas. They are mere vestiges, and afforded neither protection nor support.

The rhombic scales are thin and relatively small. Those dorsally situated in the caudal region are best displayed, and are slightly deeper than wide, measuring 5×4 mm. The ornamentation of each scale consists of about thirteen fine, rather sinuous, oblique ridges. There is a conspicuous patch of rhombic scales, 24 mm. wide, covering the anterior ventral radialia. It is likely that the scattered scales which tend to obscure the dorsal radialia in the post-abdominal region represent a similar scale-zone, probably of about the same width. This dorsal zone continued anteriorly, and rhombic scales are found mixed up with the neural spines dorsal to the abdominal cavity.

Lekanichthys *and* Dorypterus.

It is proposed to make a detailed comparison between *Lekanichthys* and *Dorypterus*. Such a comparison will suggest the manner in which certain of the very highly specialized features of *Dorypterus* have been attained, and will show that in many respects *Lekanichthys* bridges the wide gap between *Dorypterus* and its Palæoniscid ancestors. Further, a comparison with the more perfect *Dorypterus* material may illumine certain obscure points in the structure of the less well preserved *Lekanichthys*.

The most obvious difference between the two genera is that in size. All the known specimens of *Dorypterus* are quite small, an individual of average size being scarcely more than one-quarter the length of *Lekanichthys*. Otherwise the general proportions are not unlike, except that *Dorypterus* is, perhaps, deeper bodied.

The skull of *Dorypterus* was only partially ossified; the ossifications were restricted to a dorsal roofing plate, maxillæ, mandibles, and suspensory apparatus, thus leaving extensive unossified tracts on the cheek and snout. There is a strong presumption that in the skull of *Lekanichthys* the ossifications had also been reduced, leaving unossified areas similar to those found in *Dorypterus*.

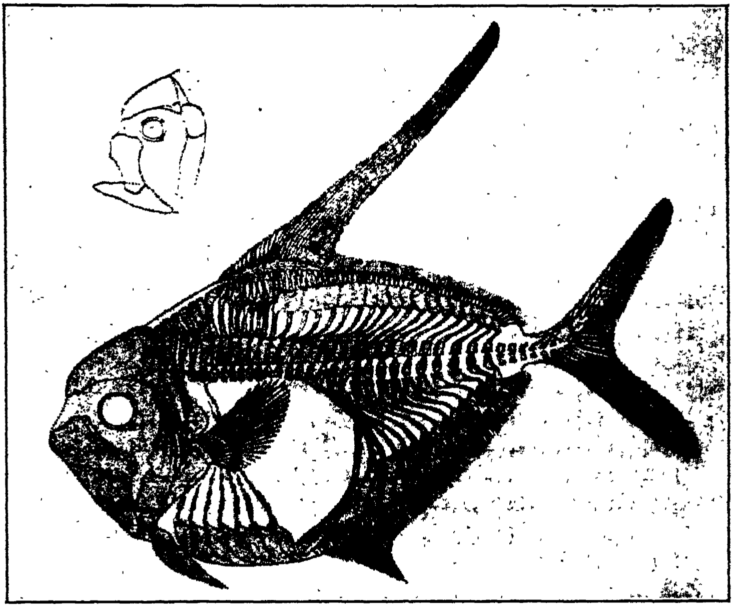
It is clear that there was a dorsal cranial shield in both genera. That of *Dorypterus* was in the form of a single piece of very thin, smooth, and unornamented bone. In *Lekanichthys* the shield was larger and more elongated, and had, on either side, a process extending downward on to the cheek. The elements of which the shield was composed were not fused up, but remained more or less distinct. The major part of the shield, that made up by the frontals, was thick and massive, and had a ganoine covering with a deeply incised ornamentation. This part was, no doubt, quite superficial; but in *Dorypterus* the whole shield was sunk in tissue, the bone was thin, and the supraorbital sensory canal, which runs deep in the bone in *Lekanichthys*, was freed from the bone altogether, and lay in soft tissue above it.

The cranial shield of *Dorypterus* could easily be derived from a type such as that of *Lekanichthys*, which is clearly less specialized; indeed, considering the frontals alone, it would be difficult to distinguish them from those of the contemporary Palæoniscids.

The bone indicated as mandible is very similar to that of *Dorypterus*, and implies the possession of a maxilla of Dorypterid type, probably to some extent free and movable, as in that genus. The edentulous condition is also a Dorypterid character which is unknown in the Palæoniscidæ. The mandible is much longer and relatively less deep than that of *Dorypterus*, and, along with other characters, indicates that the head was more elongated and, therefore, less specialized than that of *Dorypterus*.

The cleithrum of *Lekanichthys* bears little resemblance to that of *Dorypterus*, and is much more like that of the ordinary Palæoniscid. Consisting of two blades, one projecting upward and the other forward, it differs from the cleithrum of contemporary Palæoniscids only in that the angle between the two blades is greater. In the majority of the lean, predaceous Palæoniscid fishes this angle is little more than a right angle.

Text-fig. 2.



Dorypterus hofmanni (after Gill). × 1½.

The shape of this bone in *Lekanichthys* gives a pointer to the position of the pectoral fin. The place of articulation of the fin is marked clearly by the small concavity on the lower posterior margin of the cleithrum. This notch is in its usual position, where the two blades of the cleithrum meet. The lower blade is the shorter, and, assuming that its point reached almost, or quite, to the ventral surface of the fish, as it must have done, then the place of articulation of the pectoral fin was about 12 mm., or probably less than one-sixth of the depth of the head, from the ventral surface—not one-half the distance as in *Dorypterus*. The large blade of the cleithrum is dorsal to the articulatory notch and is 35 mm. long. It was, in all probability, surmounted by supra-cleithrum and post-temporal.

If the above argument is true, and the pectoral fins were situated low on the body close to the ventral surface, the pelvic fins were almost certainly post-pectoral in position, not pre-pectoral as in *Dorypterus*.

The cleithrum of *Dorypterus* is an oddly shaped element entirely unlike that of *Lekanichthys*. It consists, not of two limbs, but of one straight piece of bone, which has an angular notch for the articulation of the pectoral fin high up on its posterior border. The portion of the cleithrum below the notch is considerably longer than that above it, and the fin was situated high up on the side of the body. The assumption of this peculiar form by the cleithrum is correlated with the deepening of the body, and has been adopted from time to time by deep-bodied fishes of unrelated stocks. The living Pleuronectidæ provide a good illustration; certain members of this group possess an almost exactly similar cleithrum to that of *Dorypterus*, and have the bones of the pelvic girdle attached in precisely the same way. The cleithrum of *Dorypterus*, were it a little more slender, could be mistaken for that of the plaice.

The skeleton of the trunk and tail in the two genera under consideration is very similar superficially, but closer examination reveals differences in each series of elements. These differences all lead to the same conclusion—that *Dorypterus* is a very highly specialized fish, and that, although *Lekanichthys* shows tendencies toward modifications in the same direction, it is really much less specialized.

The notochord is less constricted in *Lekanichthys* than in *Dorypterus*. The bases of the neural and hæmal arches in the latter are close together and have a long, straight border toward the middle line, leaving a very narrow elongated passage between them. In *Lekanichthys* these inwardly directed processes of the bases of the arches did not extend so far in toward the middle line, and were separated by an appreciable gap. Further, they were not widened out toward the middle line, but were rounded.

Both the neural and hæmal arches offer further points of dissimilarity between the two genera. Accepting Gill's restoration as a true picture of the condition of these elements in *Dorypterus*, it is seen that the neural arches are simple, being much narrowed in the middle, and consisting of a small, blunt, triangular piece toward the middle line and an elongated triangular portion distally. The hæmal arches were in a similar condition. This type of arch is unique.

In *Lekanichthys* the arches are more normal. The neural arches are short, gently curved elements, each consisting of the expanded subcircular base attached to a distal rectangular body. The posterior margin describes a gentle, forwardly directed curve, while the anterior margin expands into a slightly projecting process. This projection tends to overlap the arch in front, and may have functioned as an articular process. There is no trace of such an articulation in *Dorypterus*.

The hæmal arches of *Lekanichthys* differ from those of *Dorypterus* in much the same way as do the neural arches.

The mode of articulation of the neural and hæmal arches with their spines furnishes a further distinguishing character between the two genera under discussion. Gill stresses the fact that this articulation is complex and peculiar in *Dorypterus*. The bases of the spines are prolonged proximally and overlap the distal part of the arches, both anteriorly and posteriorly. The articulation of the homologous elements in *Lekanichthys* is as simple as may be, the straight edge of the distal extremity of the arch abutting against a similar straight proximal end of the spine. The peculiar arrangement in *Dorypterus* would undoubtedly give greater rigidity, a desirable quality in such a deep-bodied fish.

In *Lekanichthys* the neural and hæmal spines form a continuous series with the radial elements which are attached to their distal extremities. The width of the spines and of the radialia is very much the same; thus a series of long bony rods extends from the notochord to the dorsal and ventral edges of the body without much variation in width. This is not so in *Dorypterus*, for in this genus there is a marked distinction between the spines and the radialia. The most obvious difference between the two series of elements is in width, and, both dorsally and ventrally, the radialia are from two to three times as wide as the spines to which they are attached. In *Dorypterus* the radialia are resolved into two groups. Each radial in both the dorsal and ventral series is a solid, broad, bony plate proximally, but it breaks up distally into a number of narrow separate elements. This number varies: the ventral radials appear to have each about four small bones attached to them distally. These, according to Gill, are separate elements suturally united to the radial plate. The greater number of the dorsal radials break up distally into three small bony rods which are not separated from the inner radial bone by sutures, but appear to be continuous with it. A few of the more anterior radials are fused to the neural spines below and simply bifurcate distally.

In *Lekanichthys* the ventral radials consist of simple elongated bony rods. The dorsal radialia, however, retain this character only in their lower portions, and distally they bifurcate simply, but rather widely. There is no break between the basal portion and the two prongs: they form one continuous element. The bifurcation of the dorsal radialia is important, since it clearly links up this genus with *Dorypterus*. It was indicated above that a few of the anterior dorsal radials of *Dorypterus* show a simple bifurcation, and are thus in a similar condition as those in the tail of *Lekanichthys*.

The squamation of *Dorypterus* is negligible, and consists of vestiges which are restricted to the belly and the caudal fin. There are seven pairs of large scales on the ventral surface, underlying the anterior part of the abdominal cavity, and, attached to these, are a few rows of weak, narrow, and degenerate scales which pass up on to the flank and die out. These scale-rows, which are the last relic of a once complete scaly covering, are identical with the narrow scale-rows which pass across the flank in the tail-region of *Lekanichthys*, and show conclusively that the method of scale-reduction was the same in both genera.

In this respect, as in most others, it is found that *Lekanichthys* is less modified, and has diverged less from the ancestral type than has *Dorypterus*. The scaly covering is not only more extensive in the former genus, but most of the individual scales are much less modified. There is a zone of rhombic scales on both the dorsal and ventral surfaces. They are thin, but otherwise are normal ganoid scales possessed of a well-marked ornament of oblique striæ, and contrast strongly with the abnormal scale relics of *Dorypterus*. In the latter genus even the seven pairs of large scales on the belly are very thin and smooth and entirely unornamented.

Summary and Conclusions.

Dorypterus was a highly specialized fish: *Lekanichthys* showed specializations of a like nature, but these were not developed to the same extent as in *Dorypterus*. In the characters in which it differs from the latter genus it displays Palæoniscid affinities. It has, therefore, all the necessary qualities of a form ancestral to *Dorypterus* and intermediate in structure between it and the Palæoniscidæ.

This simple interpretation of the relationships of the two forms is impossible, since their remains are found in the same thin stratum, indicating that they lived side by side.

There seems, however, to be no reason for doubting that *Lekanichthys* was a collateral ancestor—a form in the same group which either had evolved more slowly, or had reached a certain stage of specialization and then halted, so that, although it is not a true ancestor, it reproduces the essential form of the ancestor at a certain stage. Indeed, in all the characters which it has been possible to examine it is found that those of *Lekanichthys* could be modified to give rise to those of *Dorypterus*; in each character the structure of *Lekanichthys* was less specialized.

Thus *Lekanichthys* was of the same general build as *Dorypterus*, but was less deep-bodied. The skull-bones were more distinct, thicker, and some of them retained their external ornamentation. The cranial shield was more extensive, and the elements of which it was composed preserved their independence. The cleithrum was not much modified from the Palæoniscid form, and the pectoral fin was low on the flank. The endoskeleton of the body was more highly ossified than that of most contemporary bony fishes, and the notochord was restricted by ingrowths of the bases of the neural and hæmal arches, but it lacked the peculiar modifications of *Dorypterus*. Again, although the squamation was already being reduced, and parts of the fish were naked, the scaly covering was much more complete than that of *Dorypterus*.

It is, therefore, probable that, in early Permian time, a fish not unlike *Lekanichthys*, but of smaller size, underwent further modification to give rise eventually to *Dorypterus*.

My best thanks are due to the authorities of the Hancock Museum, Newcastle-upon-Tyne, for the loan of the specimen here described, and to Professor D. M. S. Watson, of University College, London, and Professor H. Graham Cannon, of Manchester, for much useful advice.

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EXPLANATION OF PLATE VIII.

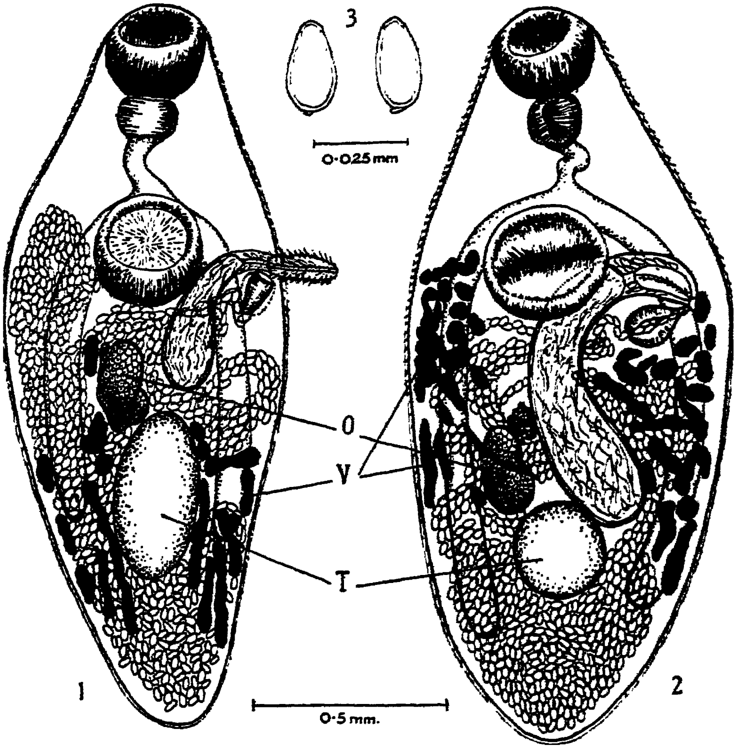
Lekanichthys howsei: photograph of the type-specimen, about one-half natural size.

XXXIII.—*Notes on* Asymphylodora tincæ (*Trematoda*).

By G. WITENBERG *and* F. ECKMANN (Department of Parasitology, the Hebrew University, Jerusalem).

DURING the dissection of six specimens of *Cyprinus carpio* brought from Lake Antioch, in Syria, the authors found three of them infected with a Trematode which has been identified as *Asymphylodora tincæ* (Moedeer, 1790). The following description is based upon the above material.

The body is oval or spindle-shaped, ca. 1·5 mm. long and 0·5–0·8 mm. wide. Live worms are reddish in colour, and change their shape during movement. The anterior part of the body is flatter and narrower than the posterior. The whole body is covered with spines, which are more conspicuous on the ventral than on the dorsal surface. Many small glands occupy the anterior part of the worm, while posteriorly they are scattered under the surface of the body. The oral sucker is globular, 0·15–0·26 mm. in diameter. The acetabulum is situated between the first and middle thirds of the body, and is a little larger than the oral sucker, being 0·26–0·34 mm. in



Asymphylodora tincæ.

Figs. 1 & 2.—Two specimens showing extreme variations in the arrangement of organs.

Fig. 3.—Eggs.

O, ovary ; *T*, testis ; *V*, yolk-glands.

diameter. The oral cavity is continued into a globular pharynx, which is approximately half the size of the oral sucker. The œsophagus is 0·15–0·19 mm., and it is usually S-shaped. The cæca are apparently contractile, and they usually reach to the last quarter of the body.

There is a single oval or spherical testis, 0·19–0·38 mm. long, situated in the posterior half of the body. The cirrus pouch is an elongated sack 0·4–0·9 mm. long, the size depending upon the amount of the accumulated sperm. It contains a big seminal vesicle, a short pars prostatica, and a protrusible cirrus. When protruded, the latter is seen to be covered with spines, which are longer than these on the surface of the body. These spines line the canal of the cirrus when the latter is inverted. The cirrus is often seen protruding from the genital opening, which is situated on the left edge of the body at the level of the posterior half of the acetabulum. The cirrus pouch crosses the left intestinal branch diagonally, and thus the seminal vesicle is situated medially to the latter and behind the acetebulum. The ovary has no constant shape, and is usually elongated and provided with small lobes. It is usually 2–3 times smaller than the testis. There is a small shell-gland situated between the testis and ovary, and there is no seminal receptacle. The yolk-glands consist of many compact groups of acini of irregular shape, often elongated, scattered on the sides of the middle or posterior third of the body; their number and situation vary in different specimens. The most anterior sometimes reach the level of the acetabulum, while the posterior ones may be found at the extreme end of the body.

The uterus has the shape of a thick tube, occupying the whole free space between the other organs behind the pharynx. In young specimens its loops are confined only to the posterior part of the body. The outlet of the uterus is transformed into a thick-walled muscular metraterm 0·09–0·17 mm. long, opening just behind the male pore. Its shape is variable, and it is lined with spines.

The eggs, when isolated from the alcohol material, are oval or pear-shaped, 0·021–0·026 mm. long and 0·011–0·013 mm. wide (according to Lühe (1909) 0·023–0·027 × 0·012–0·015 mm.), with distinct opercule and some of them are provided with a small filament, situated asymmetrically near the hind pole. It should be pointed out that in some preparations mounted in Canada balsam the eggs measure 0·035 mm. in length.

As may be seen from this description, the anatomy of *Asymphylodora tincæ* is subject to considerable individual variation. It is probable that the earlier writers attributed these particular variations to specific rank. Our material shows a chain of intermediate forms which prove their specific identity. It may therefore be concluded that other species ascribed to the genus *Asymphylodora* are merely synonyms of *A. tincæ*. The following is a critical review of those species :—

Asymphylodora ferruginosa (Linstow, 1877) of *Barbus barbus* and *Abramis brama*.—The only difference between this species and *Asymphylodora tincæ* seems to be a large filament of the eggs reproduced in Linstow's drawing. It appears probable that Linstow merely exaggerated the filament existing in the eggs of *Asymphylodora tincæ*. Therefore *Asymphylodora ferruginosa* should be considered as a synonym of *Asymphylodora tincæ*.

Distoma punctum (Zeder, 1800) of *Barbus barbus*.—This is, according to Lühe (1909), probably identical with *Asymphylodora ferruginosa*, and thus a synonym of *Asymphylodora tincæ*.

Asymphylodora expinosa (Hausmann, 1896) of *Barbus barbus*.—According to the original description this species differs from *Asymphylodora tincæ*, firstly, in the size and shape of the eggs and, secondly, in the absence of spines on the body and the cirrus. The eggs are said to be devoid of any filament, roundish, and a little smaller than those of *Asymphylodora tincæ* (0·018 mm., instead of 0·021–0·26 mm.). The difference, if proved to be constant, may be considered as of subspecific standing. The alleged absence of the spines on the body should not be taken into consideration at all, for, as recent experience in Helminthology shows, the presence of cuticular spines in Trematodes is a feature which is characteristic of all species of a genus or even of a higher taxonomic unit. Their absence in a specimen which is referred to a genus characterized by the presence of spines can be explained only by faulty fixation of material or by inadequate observation.

Asymphylodora imitans (Mühling, 1898) of *Abramis brama.*—The only difference between this species and *Asymphylodora tincæ* is in the size of the eggs—0·045 mm. instead of 0·021–0·026 mm. We have seen unusually large eggs in mounted preparations of *Asymphylodora tincæ*, and, therefore, this character cannot be regarded as conclusive.

Asymphylodora tincæ var. *kubanicum* Issaitschikoff, 1923, of *Cyprinus carpio* and *Abramis brama.*—This species corresponds in every detail to our material, and we therefore regard it as a synonym of *Asymphylodora tincæ*.

Asymphylodora macrostoma Ozaki, 1925, of *Mogurnda obscura.*—According to the original description this species differs from *Asymphylodora tincæ* in that, firstly, the pharynx is only a little smaller than the oral sucker, not half the size; secondly, the acetabulum is a little smaller than the oral sucker instead of to the contrary; thirdly, the yolk-glands are spread in front of the acetabulum, a feature not seen in *Asymphylodora tincæ*; fourthly, the intestinal crura end in front of the testis.

The size of the eggs, recorded by Ozaki—0·173–0·182 × 0·090–0·112 mm.,—cannot be considered, because his measurements are obviously misprinted, since the eggs would be larger than the ovary!

All the above-mentioned differences have, however, no specific value because they relate to anatomical structures which are contractile, and thus variable, and, moreover, they have all been observed in normal *Asymphylodora tincæ* by Loos (1894).

On the basis of the above criticism the authors came to the conclusion that there exists only one well-defined species of the genus *Asymphylodora*, namely *Asymphylodora tincæ*, while other species are either synonyms of this species, or should be re-described to prove their validity.

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XXXIV.—*On the Genera* Corbicella *and* Quenstedtia *Morris & Lycett: a Test Case in Nomenclature.* By W. J. Arkell, M.A., D.Sc., F.G.S.

[Plates IX. & X.]

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I. Introduction.

The lamellibranch genera *Corbicella* and *Quenstedtia* were founded by Morris and Lycett in their 'Monograph of the Mollusca from the Great Oolite' (1854), and the names have become well established in the European literature of the last eighty years. Mr. L. R. Cox has reviewed the genus *Corbicella* in a valuable paper on the Tancrediidæ (1929), and his reading of the rule of subsequent type-designation has led him to the conclusion that the characters of the genus should be defined *de novo*, with the result that the name becomes a synonym of *Quenstedtia* and lapses, while Morris and Lycett's original genus requires a new name. Further investigation on the same lines would deprive *Quenstedtia* also of its validity. My own conclusions, however, lead to a different result; and since the two points of view seem to be irreconcilable (in spite of discussion and correspondence), the present paper is devoted to a re-examination of the whole matter and to the provision of photographs and descriptions of Morris and Lycett's original material of both genera. The opinions of other workers on the validity of the arguments set forth would be welcomed, since the whole question of the application of the Rules is involved.

The relevant rules of the International Code of Zoological Nomenclature are Article 25, *a* & *b*, and Article 30, *a*, *e*, *g*, with Recommendation *n* (see list of references at end). For a fuller definition of a "type by subsequent designation," as mentioned in Article 30, *g*, and usually known as a lectotype, the reader is referred to the original definition by Schuchert (1905), which has been reprinted with approval by Osborn in his monumental monograph on the Titanotheres (1929), by R. B. Stewart (1926), and others.

It should be noticed that if an original author satisfies Article 25, then Article 30 is not relevant. The following considerations seem to show, not only that Morris and Lycett satisfied Article 25, but also that the so-called designations of subsequent authors do not satisfy Article 30.

II. NOMENCLATURE.

(a) *Corbicella.*

The genus *Corbicella* was described by Morris and Lycett (1854, pp. 94–5, pl. xii. figs. 13, 13 *a*) in five lines of Latin and eleven lines of English description, and the hinge of each valve, corresponding with their description, was clearly figured and the figures were referred to in the description. The essential features of generic importance are the teeth; and Morris and Lycett's description of these is as follows:—"Hinge with two cardinal subtrigonal teeth, a lengthened posterior lamina, and a remote, obtuse, posterior lateral tooth in each valve.... The character of the hinge is shown in tab. xii. figs. 13, 13 *a*."

There is no mention here of the word type; but it is clear that the original publication of the name *Corbicella* was accompanied by a definition, a description, and an indication ("The character of the hinge is shown in tab. xii. figs. 13, 13 *a*"), whereas in order to satisfy Article 25 only one of these is necessary. Hence "the valid name of the genus can be only that name under which it was first designated" (Article 25), i. e., *Corbicella*; and Article 30 need not be invoked.

Since Morris and Lycett's monograph dealt only with the Great Oolite, however, they did not at the time name the species illustrated in tab. xii. fig. 13, 13 *a*, for it was an Inferior Oolite species, chosen owing to its occurring in a soft matrix, which enabled the hinge to be especially well developed. It was refigured by Lycett three years later and named *Corbicella complanata* Lycett (1857, p. 128, pl. vi. figs. 1*a*, 1*b*). Morris and Lycett's original specimens are here for the first time illustrated photographically (Pl. IX. figs. 1, 2).

Mr. L. R. Cox's interpretation is as follows (1929, p. 577):—"Unfortunately, Morris and Lycett did not select a genotype when founding the genus *Corbicella*, and only two species cited by name (*C. bathonica* Morris & Lycett and *C. depressa* Buvignier sp.) were definitely referred by them to the genus. In these circumstances, the genotype must be fixed by priority of designation, and Stoliczka's statement (1871, p. 248) that "the type of the genus is *Corbis* (*Corbicella*) *bathonica* M. & L." is the first definite selection that I have been able to trace." Mr. Cox was the first to show, what I have since been able to confirm, that the Great Oolite species described as *Corbicella bathonica* by Morris and Lycett is not a *Corbicella* at all, but a *Quenstedtia*. They figured only the exterior, not the hinge; and they evidently never saw the hinge properly, for they stated "the dental characters are minute, and can rarely be exposed." However, Mr. Cox feels bound to accept this as the type-species on account of Stoliczka's selection, and consequently he suppresses the name *Corbicella* as a synonym of *Quenstedtia* and renames *Corbicella* auct. *Corbicellopsis* Cox.

Now this reasoning, with which many palæontologists might at first sight be inclined to agree, proceeds by four stages:—

(1) "Morris and Lycett did not select a genotype." Hence Article 25 does not apply, and we must fall back on Article 30 *g*.

(2) Subsequent type-designations must be limited to those species referred to by Morris and Lycett *by name*.

(3) Stoliczka's remark is a type-designation.

(4) It must be accepted because it is the first.

Against these conclusions I would set the following:—

(1) There can be no doubt of what Morris and Lycett had in mind when they described *Corbicella*, and they indicated unequivocally that *C. complanata* was the type,

by drawing its hinge and by referring to those drawings in their description.

(2) There is no authority in the International Rules for excluding species which, although figured and referred to, are not named. The geno-holotype of a fossil lamellibranch genus is a *shell*, not a name, and no name at all is better than a wrong one *. The least that can be conceded to the figures and descriptions of *Corbicella complanata*, which comprise the whole of Morris and Lycett's original diagnosis, is that they should rank as cotypes (=syntypes) with the two other named species mentioned thereafter, the hinges of which were not figured or described.

(3) Stoliczka's remark is not really a type-designation at all; it is not the "selection" of a "reviser" †. Stoliczka merely published a list of genera, in which he included *Corbicella*, and *he added an abstract of Morris and Lycett's diagnosis, clearly describing the teeth which are its essential feature.* Therefore *Corbicella* was for him the same as it was for Morris and Lycett, and he did not intend to make any change. When he concluded his remarks by adding "the type of the genus is *Corbicella bathonica* M. & L.," he was not selecting a new type after a revision: he was only mistakenly imparting wrong information. He did not know the hinge of *C. bathonica*, and he had not noticed that the hinges figured in Morris and Lycett's plate xii. figs. 13, 13 *a*, which he implicitly recognized as typical of the genus, did not represent *C. bathonica*, but the Inferior Oolite species, *C. complanata* Lycett.

(4) Apart from this intrinsic worthlessness of Stoliczka's so-called "selection," it is disqualified by Article 30 *e* β of the Rules, and is in opposition to Recommendation *n* and also to the original definition of a lectotype (Schuchert, 1905). Since Mr. Cox was the first to develop the hinge of "*C.*" *bathonica*, it must have been a "*species inquirenda*" to Morris and Lycett. They admit as much when they state "the dental characters are minute and can rarely be exposed." They prove it when they assign the species to *Corbicella* instead of to *Quenstedtia*, of the dental

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* Species that were wrongly named by their original authors have been accepted as genotype species.

† As required by Article 28.

characters of which they were perfectly well aware (as is shown by their description of *Quenstedtia* on the very next page). Hence *Quenstedtia bathonica* is precluded by Article 30*e*β from consideration as a cotype of *Corbicella*, for the purposes of selecting a lectotype. The only valid cotypes are therefore *C. complanata* Lycett and *C. depressa* Buv. sp. The lectotype, if one is needed, must be chosen from among these two, and the first reviser to choose one of these two species should be guided by Recommendation *n* and by the definition of a lectotype. I select *C. complanata* as being in conformity with the Rules " the best described, best figured, best known, and most easily obtainable," " of which a type specimen can be obtained " (already exists), and because by so doing I am " adhering as far as can be ascertained to the intention of the original author"*. I am not convinced, however, that Article 30 need be invoked.

(b) *Quenstedtia.*

The genotype species of *Quenstedtia* is in somewhat similar case to the genotype species of *Corbicella*. Morris and Lycett first founded the genus (1854, p. 96) with a clear and unequivocal diagnosis in both Latin and English, in the course of which they referred to three figures, one an internal cast showing the pallial sinus, the other two showing the hinge of both valves (their plate xv. fig. 12 and pl. ix. figs. 4 *a*, 4 *b*). They then proceeded to describe only a single species from the Great Oolite, under the name *Quenstedtia oblita*, which they supposed to be the *Pullastra oblita* of Phillips (1829) from Yorkshire.

Careless readers would infer from this that *Q. oblita* Phil. is the type-species of *Quenstedtia* by monotypy, for no other species was mentioned by name. But in reality the matter is by no means so simple. As with *Corbicella*, the only Great Oolite species named was misidentified. It is neither *Q. oblita* (Phil.) nor the Inferior Oolite species on which the generic description and figures of the hinge of *Quenstedtia* were based. In reality, therefore, three species are involved.

The holotype of *Pullastra oblita* Phil. came from Blea Wyke (Upper Lias ?) and has been kindly forwarded to me by Mr. Sidney Melmore from the Yorkshire Museum. It may be congeneric with the species figured by Morris and Lycett, but the valves are united; and since they are fragile, and illustrative material seems to be wanting, it is impossible either to see or to develop the hinge. I figure the holotype here (Pl. X. fig. 6). Whatever the generic characters of this species may be, it is quite certain that it is not conspecific with the much shorter and more rectangular shells from the Gloucestershire Inferior Oolite, of which the hinges were figured by Morris and Lycett as typical of *Quenstedtia.* Since these three figures are the only ones referred to in their original diagnosis, again not by name, but quite clearly by reference, the shells they represent and not the unknown *Pullastra oblita* Phil. should be considered the types. It is true that the same figures were afterwards referred to by Morris and Lycett as illustrating *Quenstedtia oblita* (Phil.), together with another figure (their fig. 4) depicting a minute Great Oolite specimen which has been renamed *Q. morrisi* by M. Cossmann (1924). But once again we must choose between actual specimens and a mere wrong name. Since the type-specimen is not a name, but a shell, there seems no reason, or even option, but to choose the actual specimen figured. The cast represented in their fig. 12 is lost, but the two well-preserved shells represented in their figs. 4 *a*, 4 *b*, showing the hinge of both valves, are in the Lycett Collection in the Museum of Practical Geology, and I therefore designate these as types. Through the kindness of the late Dr. F. L. Kitchin I have been able to borrow them and other material, and to refigure them here (Pl. X. figs. 2, 2 *a*, 3, 3 *a*).

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* See definition of lectotype (Schuchert, Osborn, Stewart, etc.).

It should be noted that the name *Q. oblita* is not mentioned in Morris and Lycett's description of the genus, whereas the two shells here regarded as types are definitely referred to. The very least that could be conceded to them, therefore, is that they should rank as syntypes of equal status with "*Pullastra*" *oblita.* But again, as with "*Corbicella*" *bathonica*, the true *P. oblita* of Phillips was—and still is—a *species inquirenda*, for its hinge was unknown to Morris and Lycett. Therefore, by Article 30 *eβ* of the Rules, it is precluded from selection as lectotype species.

The shells which thus become types of the genus *Quenstedtia* belong to a species which is common in the

Ragstones of the Inferior Oolite at Rodborough Hill, near Stroud (through the kindness of Dr. Kitchin and Mr. Cox I have ten valves before me). It was first figured by Lycett as *Platymya rodborensis* in a special paper devoted exclusively to it (1851). But between 1851 and 1854 Lycett seems to have changed his mind regarding both its generic and its specific identity, and to have come to the conclusion that his name *rodborensis* should be suppressed in favour of *oblita* Phillips. He makes no mention of his earlier paper or name, either in 1854 or in 1857, when specimens of *Q. rodborensis* were again figured, with the hinge, under the name *Q. oblita* (1857, p. 158, pl. iv. figs. 6 *a–c*).

Quenstedtia rodborensis is less elongate than most of the Jurassic forms; but so far as the hinges of the more elongate species can be seen they seem to agree well enough with the type-species (see Arkell, 1934, pl. xl.).

Externally there is much resemblance to, and there may be specific identity with, an Aalenian species figured from Alsace-Lorraine by Benecke (1905). Benecke's drawing of the hinge is puzzling, for it shows a round socket in the left valve just where the cardinal tooth ought to be, and fails to show the cardinal tooth. In the text, however, Benecke states that the tooth is present, beneath the umbo, in front of the socket.

III. GENERIC DIAGNOSES AND AFFINITIES.

(a) *Corbicella.* (Pl. IX.)

Genus: *Corbicella* Morris & Lycett, 1854.

Type: *C. complanata* Lycett, Inferior Oolite.

Synonym: *Corbicellopsis* Cox, 1929; type: *Corbis lævis* Sowerby, Corallian. (See Arkell, 1934, pl. xxxix. figs. 1–5.)

Shell equivalve, smooth, more or less compressed, elongate-ovate. Umbones contiguous and depressed, slightly anterior to the centre. The anterior end is narrower and acuter and shorter than the posterior end, though less acute than in *Tancredia*; in this respect both genera are the opposite of *Corbis*. Lunule absent. Hinge-plate and teeth rather heavy and thick, as in *Corbis*, with one large sub-trigonal cardinal tooth, and one remote, elongate, well-developed posterior lateral tooth in each valve. The posterior lateral of the left valve fits behind and slightly above that of the right valve, the postero-dorsal part of which is feebly hollowed out to receive it. Left posterior and right anterior cardinals are indistinct or absent, and there is no anterior lateral in either valve. Ligament external; nymphs prominent. Adductor muscle impressions small, orbicular or ovate, subequal, close to the hinge-line. Pallial line either gently incurved at the postero-ventral extremity or with a rudimentary, but definite, pallial sinus.

The affinities of the genus have been discussed by Mr. Cox (1929, p. 570). Originally Morris and Lycett described it as a subgenus of *Corbis*, and this position has been accepted by Fischer, Neumayr, and Rollier. Stoliczka and Zittel placed it, together with *Corbis*, in the Lucinidæ. Lastly, Mr. Cox has removed it to Meek's family Tancrediidæ, with the genera *Tancredia* Lycett, *Meekia* Gabb, and *Eodonax* Cox. Morris and Lycett, in fact, pointed out that it shows " a close approximation—almost an actual passage "—to *Tancredia* (1854, p. 91). In some respects, therefore, it forms a link between *Corbis* and *Tancredia*, and the propriety of separating these genera into two families is not beyond question. In its heavily built hinge and thick teeth and their arrangement, *Corbicella* is more closely allied to the Jurassic forms of *Corbis* than to *Tancredia*, with its slight narrow hinge and small teeth. In its lack of external ornamentation, however, and in the acute anterior end, *Corbicella* agrees with *Tancredia* and differs from *Corbis*, which has an acute posterior and a large rounded anterior end.

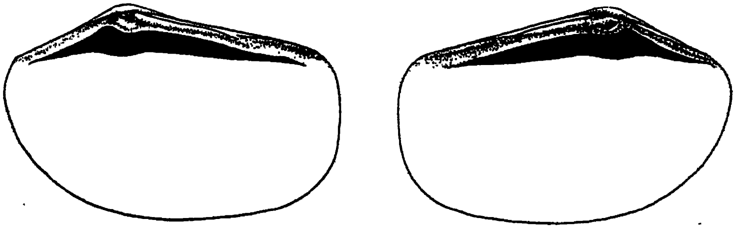
(b) *Quenstedtia*. (Pl. X.)

Genus : *Quenstedtia* Morris & Lycett, 1854.
Type : *Q. rodborensis* (Lycett), Inferior Oolite.
Synonyms : *Mactromya* Agassiz, pars, 1842.
Platymya Agassiz, pars, 1842.

Shell equivalve, inequilateral, oblong, flattened, smooth, or with slight lamellar thickening of the growth-lines on the posteal portion of the valves. Umbones anterior to the centre, small, contiguous, compressed, not prominent. Anterior end shorter and more acute than the posterior end, which is subquadrate and more or less elongate. Lunule absent. Ligament external, in a long, narrow, deep, sharply-demarcated pit.

Hinge-plate flat, parallel-sided, narrow. Hinge of left valve with a single prominent, small, acute, transversely-flattened cardinal tooth, in front of which there is a shallow socket coinciding with a sharp constriction of the hinge-plate, which produces a faint suggestion of an anterior lateral tooth as a mere slight thickening of the under side of the hinge-plate. Hinge of right valve with a single rather wide cardinal socket, in front of which is a constriction of the hinge-plate as in the left valve; but between the socket and the constriction is a more or less well-defined boss, which in some specimens of the genotype species becomes an incipient cardinal tooth. Towards the posterior end of the hinge-plate a very slight thickening suggests an incipient posterior lateral tooth in certain species. Otherwise there are no lateral teeth (text-figs. 1, 2).

Text-fig. 1. Text-fig. 2.



Quenstedtia rodborensis (Lycett); diagrams of hinge.

Fig. 1.—Right valve, based on the lectotype, Mus. Pract. Geol. no. 9151, and a topotype, British Museum no. 50949.

Fig. 2.—Left valve, based on two topotypes, British Museum, no. 67081, and Mus. Pract. Geol. no. 9152.

Inferior Oolite, Rodborough Hill, Stroud. Nat. size.

Anterior adductor muscle impression elongate; posterior rounded; both situated close to the hinge-line. Pallial line with a deep sinus, which extends almost or quite to the centre of the shell.

The affinities of this genus are problematical. Before it was given a separate name by Morris and Lycett, species were customarily referred to *Mactromya* Agassiz or *Pullastra* Sow. (*e. g*., by Phillips, 1829, pl. iv. fig. 5). It was subsequently placed in the Tellinidæ by Zittel, the Saxicavidæ by Stoliczka, and the Psammobiidæ by Fischer, although the last considered the affinities with *Psammobia* "very hypothetical." Morris and Lycett pointed out that, although *Quenstedtia* resembles *Psam-*

mobia in general form, it differs from that genus in both its hinge and its ligament. There is, in fact, no real resemblance to the dentition of the Psammobiidæ or the Tellinidæ, which are not known from strata older than the Upper Cretaceous. Still less can Stoliczka's suggestion that it belongs to the Saxicavidæ be accepted. Mr. L. R. Cox has undoubtedly done well to erect for the genus a new family, the Quenstedtiidæ (1929 *a*). He places it next to the equally peculiar genus *Sowerbya* d'Orbigny (=*Isodonta* Buvignier), for which he erects another new family, the Sowerbyidæ; and these two new families he places between the Veneridæ and the Corbulidæ. Stoliczka was inclined to ally *Quenstedtia* with the Corbulidæ, but for the ligament.

As remarked above, the general form of the shell, with the anterior part shorter and more acute than the posterior, agrees with *Tancredia* and *Corbicella*. There is a Corallian species of *Quenstedtia* that bears an extraordinarily close resemblance externally to *Corbicella complanata*. Furthermore, as we have seen, the Great Oolite species *Quenstedtia bathonica* deceived Morris and Lycett, the authors of both genera, into classing it as a *Corbicella*. The dentition, however, is fundamentally different.

There are other genera, such as *Solecurtus* and *Pleuromya*, belonging to various families, which have a single knob-like tooth in the left valve; but in none of these does the tooth grow out of a flat hinge-plate as it does in *Quenstedtia*, or fit into a simple round socket in the middle of the hinge-plate of the right valve.

The long, deep, sharply demarcated ligament pit also marks off *Quenstedtia* from these other genera. This last feature more nearly allies it to a certain Mesozoic genus hitherto classed under *Tellina* and *Lucina* and without a distinct name, elsewhere (1934) to be described as *Ampliata* *. The systematic position of this genus is in turn by no means obvious, though it seems best accommodated in the Lucinidæ. *Ampliata* has a single cardinal tooth in the left valve and a simple correspondng socket in the right valve, with no laterals. But the cardinal tooth is quite different from that in *Quenstedtia*, being subtrigonal and scarcely raised above the plane of the hinge-plate—merely demarcated by two divergent shallow grooves. The cardinal socket in the right valve is correspondingly shallow, ill-differentiated, and subtrigonal. The hinge-plate is also quite differently shaped, more as in the Lucinidæ. On the whole, in spite of the similar ligament, it seems unlikely that *Ampliata* and *Quenstedtia* can be closely related.

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* Type, "*Tellina*" *ampliata* Phillips, from the Yorkshire Corallian.

So far as our present knowledge goes, it only enables us to consider the Jurassic genus *Quenstedtia* as the sole representative of a special family, of which the systematic position has still to be determined.

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EXPLANATION OF THE PLATES.

PLATE IX.

Figs. 1, 2. *Corbicella complanata* Lycett. Genotypes.

Fig. 1. Left valve.
Fig. 2. Right valve, holotype.

Ragstones of the Inferior Oolite, Rodborough Hill, Stroud, Gloucestershire. Lycett collection, Mus. Pract. Geol. nos.

52878 and 9147. (Figured in Morris and Lycett as illustrative of the hinge of *Corbicella*, 1854, pl. xii. figs. 13, 13 *a*; and in Lycett, 1857, pl. vi. figs. 1 *a*, 1 *b*, reduced.) Natural size.

PLATE X.

Figs. 1–5. *Quenstedtia rodborensis* (Lycett). Genotypes and geno-topotypes. All natural size.

Figs. 1, 1 *a*. Left valve showing the hinge to perfection. Inferior Oolite of Cold Comfort, near Cheltenham, Gloucestershire. British Museum no. 67081.

Figs. 2, 2 *a*, 3, 3 *a*. Genotypes: Right and left valves. Ragstones of the Inferior Oolite, Rodborough Hill, Stroud. Lycett collection, Mus. Pract. Geol. nos. 9151, 9152. (Figured in Morris and Lycett as illustrative of the hinge of *Quenstedtia*, 1854, pl. ix. figs. 4 *a*, 4 *b*.) They are also topotypes and possibly syntypes of *Q. rodborensis* (Lycett). (Figured Lycett, 1851, p. 84.) The left valve no. 9152, is unusually elongate and may be specifically distinct. I hereby designate the right valve, no. 9151, as lectotype of *Q. rodborensis*, since it agrees most nearly with the figure of a complete valve among Lycett's original sketches (1851, p. 84).

Figs. 4, 4 *a*. Left valve, topotype and geno-topotype. Lycett coll., Mus. Pract. Geol. no. 9156. (Probably the specimen figured as *Q. oblita* in Lycett, 1857, pl. iv. fig. 6 *a*.)

Fig. 5. Dorsal view of double-valved specimen: topotype, geno-topotype. Lycett coll., Mus. Pract. Geol. no. 52886.

Fig. 6. (?) *Quenstedtia oblita* (Phillips). Holotype (crushed and the posterior imperfect). Lower Inferior Oolite or uppermost Upper Lias, Blea Wyke, Yorkshire. Yorkshire Museum, York.

XXXV.—*On Two "Red Duikers" from Mt. Elgon and Mt. Kenya, East Africa.* By J. ST. LEGER, F.Z.S. (From the Zoological Department, British Museum (Nat. Hist.).)

THE British Museum has lately received specimens of "red duikers" from Mt. Elgon and Mt. Kenya respectively. These differ from all described species, although they appear to be closely related to *nigrifrons* of the Congo and *rubidus* of Mt. Ruwenzori. The hair is long and soft, only slightly shorter on the shoulders than on the rump, and the hoofs and false hoofs are large in comparison with the size of the body, as in the *nigrifrons-rubidus* group.

The duiker from Mt. Elgon has been sent by Mr. G. W. Foster, who has presented a splendid series of some 70 specimens to the British Museum. I have pleasure in naming it

Cephalophus fosteri.

Size smaller than *rubidus* ; ears smaller, *circa* 72 mm. (83 mm. in *rubidus*). Skull smaller, with shorter, lighter horns than in *rubidus*. Base of hair of mid-dorsal line smoky grey instead of brown as in *rubidus* ; black colouring of face less marked and extensive than in *rubidus*.

General colour dark chestnut, hairs of dorsal surface distinctly annulated with black ; annulations disappearing on flanks, where the colour merges gradually into the non-annulated yellowish brown of the ventral surface. Base of hairs of mid-dorsal line smoky grey, very different from the base of the hairs of the same region of *rubidus*, which is brown, with only a few steel-grey hairs intermixed. On the flanks the base of the hairs is smoke-grey instead of steel-grey as in *rubidus*, and the colour changes gradually from grey to the yellowish white of the basal portion of the hairs of the mid-ventral line. Chin-patch white. Face chestnut-brown ; hairs of face not annulated, except in the region of the face-blaze. Face-blaze much less strongly marked than in *rubidus*, dark brown in colour, the individual hairs more or less strongly annulated with chestnut-yellow. In the type-skin this annulation of the face-blaze with yellow is so strong that the brown colouring is almost obliterated. Crest black. Ears comparatively small, outer surface dark brown, inner surface pure white. Legs dark brown, the colour occupying much the same area as in *rubidus*. Tail black and white, with proportionately many more white hairs than in *rubidus*.

Type.—Adult male (B.M. no. 31.11.1.87), from Mt. Elgon, East Africa, 9300 ft. Flat skin. No measurements taken.

Skull.—Greatest length 161 ; condylo-basal length 153·5 ; zygomatic breadth 71 ; least interorbital breadth 36 ; greatest breadth brain-case 51 mm. Horns : length 61 ; breadth at base 24 mm.

No skull-measurements of *rubidus* were included in the original description, as this description was based on a flat skin, without head, purchased from natives. Measurements of a skull obtained later from Ruwenzori East are as follows, and are here inserted for purposes of comparison with those of *C. fosteri* :—

Male (B.M. no. 6.7.1.199).—Greatest length 172 mm.; condylo-basal length 163·5; zygomatic width 78·5; least interorbital width 42; greatest breadth brain-case 56 mm. Horns: length 92; breadth at base 25.

"It inhabits the thicker forests at an altitude of from 8000 to 11,300 ft. It is most frequently met with at 9700 ft., where it breeds in the thickest parts of the bamboo forest, where the old and dry bamboo leaves lie so thick on the ground that they advertise the approach of even the smallest carnivorous animal long before it can reach the doe and young.

"When startled it gives a warning whistle exactly like many other small buck, but it is the only buck I know which is capable of making a thumping noise similar to that made by the common English rabbit. It makes this noise only when it runs."

Mr. Foster goes on to say that he hunted for kick-marks in the soft ground caused by this thumping, but failed to find any, and eventually asked the local natives about it. These assured him that the buck made the noise "in their chests."

From Mt. Kenya Mr. Raymond Hook sends a male and a female specimen of a "red duiker," of which he writes :—

"Its native name is 'Kichachu,' and it seems to live exclusively in the bamboos at a level of between 8500 and 10,000 ft. on S.W. of Mt. Kenya." It is closely related to *fosteri*, and may be called :—

Cephalophus hooki.

Differing from *fosteri* by smaller ears (length 64 mm.), greater extent of annulation of pelage, and more strongly marked face-blaze.

General colour slightly paler than *fosteri*. Hair of dorsal surface annulated dark brown and ochraceous-yellow, the annulations extending over the flanks and the greater portion of the face. Base of hairs pale grey, rather paler on the ventral than on the dorsal surface. Chin-patch yellowish white, as far as it can be judged from the flat skins. Face pale yellowish brown, hair of cheek and side of muzzle distinctly annulated; a line about 14 mm. in width above each eye yellowish brown, not annulated. Face-blaze strongly marked, black, crest black. Ears smaller than in *fosteri*, outer surface dark brown, inner surface pure white. Legs dark brown, extent of colouring as in *fosteri*. Tail brown and white, whiter than in *fosteri*, the brown colouring occupying only the proximal third of the tail.

Type.—Adult male (B.M. no. 34.3.17.1), from S.W. face Mt. Kenya, East Africa, 8500–10,000 ft. Flat skin, hind foot 193 mm. Ear 64 mm. (taken from flat dried skin).

Skull.—Greatest length 163 mm.; condylo-basal length 154·5; zygomatic width 71; least interorbital width 39; greatest breadth of brain-case 53·5. Horns: length 65; greatest basal breadth 21.

XXXVI.—*Notes on some European Upper Cretaceous Corals.* By JOHN W. WELLS, Ph.D., National Research Fellow.

THE present notes are the partial results of investigations on fossil and recent corals being carried out by the author under a National Research Council Fellowship in the Biological Sciences at the British Museum (Nat. Hist.). Thanks are due from the author to the National Research Council (Washington, D.C.) for the opportunity of carrying out this research, and to the authorities of the British Museum (Nat. Hist.) for the facilities afforded him during his period of work in that institution.

I.

In 1832 Sowerby figured, but did not describe, nine new species of corals from the Gosau beds in connection with Sedgwick and Murchison's paper on the structure of the Eastern Alps *. Some at least of these were collected by Murchison, and the types of several were later given by him to the Geological Society, and are now in the collections of the British Museum (Nat. Hist.). Two specimens have been so far identified as types of two of Sowerby's species.

The recognition of these specimens involves two changes in the nomenclature of some importance.

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* Trans. Geol. Soc. London, 2, ii. pl. xxxvii. figs. 1–9.

First is the type of *Astrea formosissima* (Sowerby's fig. 6), B.M. no. R. 11609. This is a species of the genus *Astrocœnia* with a ramose corallum and twenty decamerally arranged septa, and is the species usually referred to in the literature as *Astrocœnia decaphylla* (Michelin). Part of the present confusion is because Michelin used the name *Astrea formosissima* twice in error—first, in 1841 †, for a species later named *Isastrea guettardi* by Edwards & Haime ‡, and second, in 1847 §, for a species of massive *Astrocœnia* with sixteen octamerally arranged septa named *A. orbignyana* by Edwards & Haime ||. In 1851 Edwards & Haime made a most unfortunate mistake in applying Sowerby's name to a species of *Stephanocœnia* with twenty-four hexamerally arranged septa ¶, and this name has persisted for eighty-one years. Sowerby's figure should have revealed the incorrectness of this reference to *Stephanocœnia*, for it clearly shows only twenty septa and the lack of any pali; but in the latest and most pretentious work on the Gosau corals †† we find the author using the name *Stephanocœnia formosissima*. Evidently he had neither consulted the original figure nor seen the type of *Astrea formosissima*.

The following is a list of names used by Sowerby, Michelin, and Goldfuss, with their correct usage at present :—

Astrea formosissima Sowerby, 1832=*Astrocœnia formosissima* (Sow.).

**Astrea formosissima* Michelin, 1841=*Isastrea guettardi* E. & H.

**Astrea formosissima* Michelin, 1847=*Astrocœnia orbignyana* E. & H.

**Astrea reticulata* (pars) Goldfuss, 1829=*Astrocœnia reticulata* (Goldf.).

Astrea reticulata Michelin, 1841, 1847=*Stephanocœnia striata* (Goldf.).

**Astrea formosa* Goldfuss, 1829=*Stephanocœnia formosa* (Goldf.).

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† Michelin, H., 'Iconographie Zoophytologique,' xxiii. pl. vi. fig. 4.

‡ Edwards, H. M., & Haime, J., Pol. Foss. Terr. Pal. 1851, p. 103.

§ Michelin, H., *op. cit.* p. 304, pl. lxxii. fig. 5.

|| Edwards, H. M., & Haime, J., Ann. Sci. Nat. 3, x. 1849, p. 267.

¶ Edwards, H. M., & Haime, J., Pol. Foss. Terr. Pal. 1851, p. 66.

†† Oppenheim, P., 'Anthozoen der Gosauschichten,' 1930, p. 474.

**Astrea formosa* Michelin, 1847=*Astrocœnia konincki* E. & H.
**Astrea ramosa* Sowerby, 1832=*Astrocœnia ramosa* (Sowerby).

The starred names are those on which there is general agreement as to the species and their nomenclature. In the case of the others further explanation and brief summaries of the synonymies are desirable.

Astrocœnia formosissima (Sowerby).

Astrea reticulata (pars) Goldfuss, 1829 (pl. xxxvii. figs. 10 *a*, *d*, non figs. 10 *b*, *c*).
Astrea formosissima Sowerby, 1832.
Astrea decaphylla Michelin, 1847.
Astrocœnia decaphylla E. & H., 1849.
Astrea reticulata Quenstedt, 1852.
Astrocœnia decaphylla Reuss, 1854.
Astrocœnia decaphylla E. & H., 1857.
Astrocœnia decaphylla de Fromentel, 1863.
Astrocœnia decaphylla Duncan, 1869.
Astrocœnia reticulata decaphylla Quenstedt, 1881.
Astrocœnia decaphylla Felix, 1903.
Astrocœnia decaphylla Felix, 1914.
Astrocœnia decaphylla Oppenheim, 1930.

This is the only decameral species of *Astrocœnia* occurring in the Gosau beds.

Stephanocœnia striata (Goldfuss).

Astrea striata Goldfuss, 1829.
? *Porites aculeata* Michelotti, 1838.
Astrea reticulata Michelin, 1841.
Astrea reticulata Michelin, 1847.
Astrea striata Michelin. 1847.
Astrea variolaris Michelin, 1847.
Stephanocœnia formosa E. & H., 1849.
Columastrea striata d'Orbigny, 1849.
Columnastrea striata E. & H., 1850.
Phyllocœnia variolaris d'Orbigny, 1850.
Columellastrea striata d'Orbigny, 1850.
Stephanocœnia formosissima E. & H., 1851.
Columnastrœa striata Reuss, 1854.
Columnastrœa striata E. & H., 1857.
Stephanocœnia formosissima E. & H., 1857.
Columnastrœa striata Pictet, 1857.
Columnastrœa striata de Fromentel, 1861.
Stephanocœnia formosissima de Fromentel, 1861.
Astrœa striata Quenstedt, 1881.
Columnastrœa striata de Fromentel, 1884.
Stephanocœnia formosissima de Fromentel, 1884.
Stephanocœnia dumortieri de Fromentel, 1884.
Stephanastrœa dumortieri de Fromentel, 1886.
Columnastrœa striata Felix, 1898.
Columnastrœa striata Söhle, 1899.

Columnastræa striata Felix, 1903.
Columnastræa striata Felix, 1914.
Stephanocœnia formosissima Felix, 1914.
Stephanocœnia formosissima Oppenheim, 1930.
Columnastræa striata Oppenheim, 1930.
Columnastræa variolaris Oppenheim, 1930.

It is surprising that no previous suggestion seems to have been made about the similarity between the supposedly distinct genera and species usually known as *Columnastræa striata* and *Stephanocœnia* "*formosissima.*" A careful examination of topotypes of these two "species," together with others, including specimens of de Fromentel's *Stephanastræa dumortieri*, made by the author in the British Museum, shows that only one species is involved, referable to the genus *Stephanocœnia*, and that it takes the earliest specific name applied to it—Goldfuss's *striata*. The various "species," such as *variolaris*, have been based merely upon growth-forms and results of fossilization. For proof of this one need only consult the good figures of *striata*, "*formosissima*," and *variolaris* given by Oppenheim in his 'Anthozoen der Gosauschichten" *.

The second change, of less far-reaching effects than the first, involves the species illustrated in Sowerby's fig. 7, and by him named *Astrea ambigua*. An examination of the holotype specimen, B.M. no. R. 11610, shows it to be identical with Oppenheim's *Nefocœnia decussata* †, which should therefore be called *Nefocœnia ambigua* (Sowerby).

Of the remaining types of Sowerby's species—those of *Astrea ramosa*, *A. tenera*, *A. media*, *A. grandis*, *Cyathophyllum compositum*, *Turbinolia rudis*, and *T. aspera*—there is no trace, although a specimen in the British Museum, no. R. 7090, may be the type of *T. aspera*. None of Sowerby's Gosau corals are listed in Blake's list of the Geological Society's type-specimens (1902).

II.

Felix ‡, in 1914, placed *Aulopsammia* Reuss § in the synonymy of *Epiphaxum* Lonsdale ||, and included under the latter name *A. murchisoni* Reuss, monotype of

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* Pl. xliv. figs. 2–2 *b*; pl. xxxvi. figs. 9–9 *b*; pl. xliv. figs. 3–4.

† Oppenheim, P., *op. cit.* 1930, p. 421, pl. xxxix. figs. 2–4.

‡ Felix, J., Fossilium Catalogus I.: Animalia, Pars 7, 1914, p. 248.

§ Reuss, A. E., Beitr. z. Charact. Kreideschichten Ostalpen, 1854, p. 130.

|| Lonsdale, Wm., in Dixon, F., 'Geology of Sussex,' 1850, p. 261.

Aulopsammia, *A. lithothamnoides*, *A. reptans*, and *A. vermiculata* Felix, 1903. In this course Felix has been followed by Oppenheim [*], and both were apparently confirming Reuss's opinion that the two genera were the same without having actually seen Lonsdale's specimen. The author has seen the holotype of Lonsdale's genotype in the British Museum (Nat. Hist.) (no. D. 2941), and can state that *Epiphaxum* is a genus with no relationships with either the Poritidæ or other perforate Madreporaria, but belonging either to the Alcyonaria or to the Hydrocorallinæ. Perhaps none of the Gosau species belongs to it. The essential structure of *Epiphaxum* is the solid central axis of the corallites, surrounded by eight pores communicating with the cœnenchyme. *Aulopsammia* has well-developed pseudo-septa, usually more than eight in number, with an empty corallite axis. Oppenheim considers that the Gosau species of *Aulopsammia* are related to *Actinacis*, and the figures given by Felix [†] of the internal structure of *A. lithothamnoides* and *A. vermiculata* show that in these two species at least a perforate madreporarian condition is present. Similar structure is found in a species which the author has described from the Glen Rose formation (Aptian) of Texas as *Epiphaxum labyrinthica* [‡]. Whether or not the type-species of *Aulopsammia* possesses the same structure has not yet been shown, although Oppenheim's figures [§] seem to indicate that such is the case.

III.

Pratz founded his genus *Mesomorpha* [||] upon two of Reuss's Gosau species—*Porites stellulata* and *P. mammillata*. No genotype was designated, but the type of *Mesomorpha* was fixed in 1911 when Trauth removed *P. stellulata* as the genotype of his genus *Ahrdorffia* [¶], and *P. mammillata* is therefore taken as genolectotype of *Mesomorpha*. The two genera thus constituted, as one can see from Reuss's figures *, are quite distinct from each other. *Ahrdorffia* is very closely related to the recent genus *Psammocora*, a type having some affinities with the perforate Madreporaria, indicated by the splitting of the septa at the periphery of the corallite and the almost invariable presence of the septo-costæ in the intercostal spaces—or, in other words, the septa are not continuous with the costæ as they are in the other suborders of the Madreporaria, and are connected with two or more septo-costæ which may be confounded in the intercorallite areas to form a porous cœnenchyme. The septa are imperforate and the septo-costæ may vary from imperforate to perforate. Further investigation is needed to determine whether or not these forms should be placed in the Perforata. *Mesomorpha*, on the other hand, is closely related to, if not a synonym of, *Thamnasteria*. Oppenheim considers it to be intermediate between *Thamnasteria* and *Siderastrea* †, apparently basing this conclusion on the supposition that *Thamnasteria* died out at the close of the Mesozoic and that *Siderastrea* is primarily a Tertiary and Recent genus. It should be noted here, in passing, that the name *Mesomorpha* is not available for a genus of corals, having been preoccupied in 1837 by Hodgson for a genus of birds. It is therefore surprising to find that Oppenheim has recently placed the species *stellulata* and *mammillata* together under the name *Mesomorpha mammillata*, with numerous figures of both forms. Figs. 3, 3 *a* on his pl. xx. are *Ahrdorffia stellulata*, as are also figs. 18, 19 on pl. xxxi. and fig. 9 on pl. xxxvi., while pl. xxxvi. fig. 8 shows *M. mammillata*. His reason for this union of the two species under a single name is that the septa in *A. stellulata* are considered to be "uniting" to a great extent rather than dividing. If this were true, we ought to find that the costæ in this form are continuous and directly confluent between the corallites, but his fig. 8 (pl. xxxix.) shows that they are not.

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[*] Oppenheim, P., 'Anthozoen der Gosauschichten,' 1930, p. 21.

[†] Felix, J., "Anthozoen der Gosauschichten," 'Palæontographica,' xlix. 1903, text-figs. 66 *a*, 67.

[‡] Wells, J. W., "Corals of the Trinity Division of the Comanchean of Central Texas," Journ. Pal. vi. 1932, p. 254, pl. xxxvii. fig. 8.

[§] Oppenheim, P., *op. cit.* 1930, pl. xxxvi. figs. 3–6.

[||] Pratz, E., 'Palæontographica,' xxix. 1882, p. 115.

[¶] Trauth, F., "Die oberkretazische Korallen-fauna von Klogsdorf in Mähren," Zeitschr. Mähr. Landesmus. xi. 1911, p. 191.

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* Reuss. A. E., Beitr. z. Charact. Kreideschichten Ostalpen, 1854, pl. x. figs. 9–10, pl. xiii. figs. 9–10.

† Oppenheim, P., 'Anthozoen der Gosauschichten,' 1930, p. 246.

XXXVII.—*Notes on the Fauna of a Mountain Slope in the Pyrenees.* By B. J. Marples, M.A., M.Sc., Manchester University.

During a twelve-day visit to Bagnère de Luchon, Haute Garonne, between July 29th and August 10th, 1933, observations were made on the fauna, and collections were taken at different levels on the side of a mountain. Luchon is situated at the end of the valley of the River Pique, a tributary of the Garonne. It is a large valley, flat at the bottom, and about half a mile broad. The sides are very steep, and thickly covered with trees down to the level floor of the valley, which is cut up into fields, mostly of pasture, mowing grass or maize. The bottom of the valley in the vicinity of Luchon is about 2000 feet above sea-level, and the forest extends up the sides to the height of about 6000 feet. Above the level of the forest is mountain pasture land, covered with short grass, on which numbers of cows are grazed.

Connecting Luchon and the hotel of Superbagnères, 4000 feet above, is a rack railway, the whole of whose track runs through the forest. By ascending on this railway one gets an excellent impression of the gradual change in the forest which takes place with increasing height. The lower part consists of deciduous trees, in some places almost entirely beech, but in others a mixture of ash, lime, sweet chestnut, sycamore, and hazel. At a height of about 4000 feet the deciduous trees become mixed with conifers, and above that level there is a pure coniferous forest, consisting of *Picea excelsa.*

The vegetation was not studied in detail, but a number of the more conspicuous plants were collected for identification. From the railway a conspicuous change was noticeable in the commonest flower. Up to about 4000 feet a pink flower resembling willowherb, but not identified, predominated. In the next thousand feet it was replaced by a tall plant with pale blue flowers, *Mulgedium plumieri*, while in the topmost region the blue flower was replaced by a pink one like a valerian. A saxifrage was also common in this last region. It was remarkable how sharp was the change-over from one predominant flower to the next.

The plants of the open pasture at the top were very like those of an English meadow, plants such as yarrow, thyme, and harebell being common. There were many plants of the large yellow gentian, *Gentiana lutea*, dotted about, a little dwarf juniper, *Juniperus communis*, and a very little Ling, *Calluna vulgaris*. In one place, at a little over 6000 feet, was about an acre of alpenrose bushes, *Rhododendron ferruginea*, two or three feet high.

The alpenrose bush and mountain pasture regions seemed, from a general survey, to be particularly rich in animals. Diptera were numerous, including several species of Tabanids; bumble-bees and ordinary bees were common, several wasps were seen, and at least two species of ants. Two nests of *Formica rufa* were found several hundred feet above the tree-level. Butterflies were not very numerous or conspicuous, the commonest being a small fritillary.

In the valley lizards were very numerous, but only one was seen at the top, in the alpenrose bushes. Large numbers of house-martins were nesting under the eaves of the Hotel Superbagnères, and were common flying over that part of the hillside. On one occasion a great many swifts appeared at about five o'clock in the evening, none having been seen previously that day. A pair of ravens, an eagle, and a number of buzzards were also seen flying over. Only one ground-bird was seen, an unidentified warbler in the alpenrose bushes.

Birds were very scarce in the forest, as would be expected, but a few tits were noticed in the tops of the conifers. In the valley, on the lower edge of the trees, small birds such as tits, chaffinches, and bullfinches were common.

The weather was cloudless and very hot, so that the temperature on the bare mountain pasture was much higher than that in the pine forest. On one occasion the air-temperature in the open was 67° F, and that on the ground in the shadow of a tuft of plants was 70° F. In the shade in the pine wood it was 57° F., while in direct sunlight an ordinary thermometer rose to 117° F.

Quantitative collecting of animals was carried out at the different levels on the mountain. In the grass and herbs this was done by making six sweeps, approximately 1 metre in length, with a net 30 centimetres in diameter. The contents of the net was shaken into a cyanide jar, and then preserved in alcohol, the animals being picked out under the dissecting microscope later. This procedure was repeated twice at each place, and the average of the two results taken. Collections were made in this way in six regions: the alpenrose bushes, the mountain pasture, the coniferous forest, the transitional forest between the coniferous and deciduous regions, the deciduous forest, and the mowing-grass on the floor of the valley.

The results of the collections in the herbs are shown in Table I. (p. 394). Here the average number of animals taken in the two sets of six sweeps is shown, and the numbers of the various groups most strongly represented. It will be seen that the number of animals captured falls off steadily with increasing height in the forest. In the grass it is noteworthy that far the greater number of animals was taken at the top. A possible explanation is that this was pasture, whilst that at the bottom was mowing-grass.

Four of the different groups, froghoppers, spiders, mites, and Diptera, decrease in numbers with increasing height, while only one, the round-bodied springtails, shows any tendency to increase, and the numbers of these are too small to have any significance. In the grass fields the only groups much more numerous in the mowing grass than in the pasture are the Hemiptera, excluding the froghoppers, and the spiders. The greatest number of animals taken in six sweeps was 328 in the mountain pasture, and the smallest number was 19 in the alpenrose bushes.

An attempt was made to sweep in the shrubs and lower boughs of the trees, but this proved impracticable owing to the stiffness of the branches, and a different method was tried. Instead of making strokes, the net was held under a thick piece of foliage, which was then shaken violently. Therefore, in contrast to the collections in the herbs, those in the shrubs consisted of two sets of six shakes. Collections were made in this way in the coniferous, transitional, and deciduous regions of the forest. It must be borne in mind that the results obtained by shaking and sweeping are not really comparable, though they are included in the same table for convenience.

The collections made by shaking the shrubs are not so uniform as those made by sweeping, that in the transitional forest being the smallest, with 114 animals, and that in the coniferous forest largest, with 322·5, the very large number here being mostly due to mites. In each case, the total number of animals taken in the shrubs was greater than that in the herbs, possibly owing to the method used in collecting. Nevertheless, it is significant that the ratio of the numbers in the different groups, collected in the herbs and shrubs, changes at different levels. Some, such as the long-bodied springtails, are more numerous in the herbs at all levels, and some, such as the Psocids, are more numerous in the shrubs. The Hemiptera and the Hymenoptera, however, are more

Table I.—Showing the average numbers of the principal groups of animals taken by quantitative collecting at different levels on the mountain.

	Deciduous forest.		Transitional forest.		Coniferous forest.	
Height	2000 feet.		4000 feet.		6000 feet.	
Stratum	Herbs.	Shrubs.	Herbs.	Shrubs.	Herbs.	Shrubs.
Total animals	117·5	155·5	103·0	114·0	79·0	322·5
Long springtails ..	5·5	1·0	10·5	6·5	5·5	3·0
Round springtails .	0·5	1·5	0·5	0·0	3·5	0·0
Froghoppers	9·5	4·5	8·0	15·0	2·0	1·0
Other Hemiptera .	17·5	26·5	21·0	19·0	11·0	2·5
Hymenoptera	12·0	33·0	5·0	5·0	10·5	3·5
Mites............	12·5	47·5	8·5	13·5	3·5	174·5
Spiders	10·5	15·0	9·0	0·5	3·5	8·0
Total Arachnids ..	23·5	63·0	17·5	14·5	7·0	183·0
Diptera..........	42·0	8·0	33·0	13·5	13·0	8·0
Psocids	4·0	9·5	2·0	33·0	0·0	16·5

	Alpenrose bushes.	Mowing-grass-field.	Mountain pasture.
Height..............	6000 feet.	2000 feet.	6000 feet.
Total animals........	23·0	163·5	284·0
Long springtails......	0·0	0·0	31·0
Round springtails	0·0	13·0	53·5
Froghoppers	0·0	31·0	74·5
Other Hemiptera	0·5	59·5	12·5
Hymenoptera........	0·0	16·0	15·5
Mites	0·0	19·0	30·0
Spiders	1·0	18·5	2·0
Total Arachnids	1·0	38·0	32·0
Diptera	7·0	16·5	50·0
Psocids	11·5	2·5	1·0

numerous in the shrubs in the deciduous forest, but, on reaching the coniferous forest, they are more plentiful in the herbs.

In the eighteen collections of animals made by sweeping and shaking, as described above, the total number of animals taken was 2624. Table II. gives the percentages of the different groups of this total number. As would be expected, insects form by far the greatest proportion of the total, but the high percentage of mites is striking, particularly as this group is seldom mentioned in other quantitative work on animals. It is unfortunate that figures comparable to those shown in the table do not seem to have been published by other workers.

TABLE II.—Showing the total numbers of animals found in quantitative collecting in the herbs and shrubs, and the percentages of the various groups.

Group.	Number of Animals found.	Percentage.
Total animals	2624	100·0
Total insects	1795	68·4
Total Arachnida	759	28·9
Mites	618	23·6
Diptera	378	14·4
Froghoppers	346	13·2
Hymenoptera	201	7·7
Psocids	160	6·1
Other insects	155	5·9
Round springtails	145	5·5
Other Hemiptera	137	5·2
Spiders	136	5·2
Long springtails	126	4·8
Beetles	79	3·0
Aphids	68	2·6
Snails	41	1·6
Myriapods	25	0·9
Phalangids	4	0·2

Summary.

The paper deals principally with the results of quantitative collecting carried out in the herb-stratum of six different regions on a mountain-slope, between the heights of 2000 and 6000 feet. In passing upwards from deciduous to coniferous forest a decrease in the number of animals was observed, and figures are given showing the numerical distribution of the different orders of animals. Quantitative collecting was also carried out in the shrub-stratum, and similar figures are given for the animals obtained there.

XXXVIII.—*On a new Palæoniscid Fish from Turkestan.*

By Errol Ivor White, Ph.D., F.G.S., Geological Dept., British Museum (Nat. Hist.).

In 1928 Professor T. D. A. Cockerell, of Colorado University, returned from a visit to the U.S.S.R. with a small collection of fishes from Turkestan, which he generously presented to the British Museum. The collection comprised seven specimens, all apparently of one species, belonging to the Palæoniscid genus *Coccolepis* Agassiz. This genus is the last of the Palæoniscids, first occurring in the Lower Lias and making its final appearance in the Wealden. Hitherto it has been found in the south of England, Bavaria, Belgium, and New South Wales, so that this extension of its range eastwards is worth putting on record.

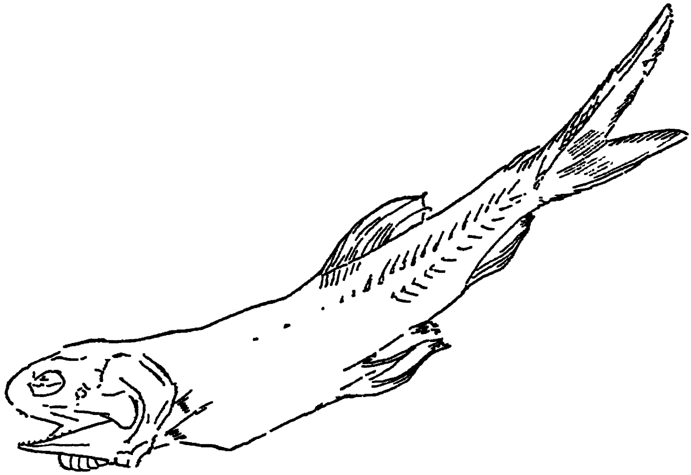
Coccolepis cockerelli, sp. n. (See figure.)

Specific Characters.—A *Coccolepis* of very slender proportions and small size, no known specimen exceeding 55 mm. in total length. Maximum depth of trunk equal to about two-thirds length of head with opercular apparatus, and comprised nearly seven times in total length. Teeth stoutly conical and incurved. Cranial and facial bones apparently ornamented with coarse rounded tubercles. Ventral fins with long base, consisting of at least thirty rays and arising about midway between pectorals and anal. Dorsal fin arising slightly in advance of middle point of back and somewhat behind origin of ventral fins, and consisting of at least thirty-five rays; its maximum height slightly exceeding length of its base and greater than depth of trunk at its origin by approximately one-fifth. Anal fin extended and somewhat longer than high, with rather more than twenty-five rays, and arising completely behind level of dorsal fin.

Material.—The holotype, a complete fish (Brit. Mus. no. P.14528), and six other imperfect specimens (Brit. Mus. nos. P.16379–83, P.16460).

Formation and Locality.—Jurassic: near Galkino, Turkestan.

Description of Specimens.—The measurements of the holotype are as follows:—Total length 52 mm.; length to base of caudal pedicle 38 mm.; maximum depth 8 mm.; depth of caudal pedicle 3·5 mm.; length of head to hinder margin of opercular apparatus 11 mm. A second but less perfect specimen (P.16381), measuring 51 mm. in total length, has similar proportions, but a headless fish, P.16383, is rather deeper anteriorly, probably owing to distortion. The other specimens consist of a second fish without the head (P.16379), two isolated heads (P.16380, P.16460), and an isolated and imperfect tail (P.16382).



Coccolepis cockerelli, sp. n. The holotype (Brit. Mus. no. P. 14528). Jurassic: near Galkino, Turkestan. × 2.

The holotype is complete, save for the flaking away of a few fragments of the squamation; nevertheless, as the specimen is laterally compressed and encrusted slightly with mineral matter, the state of preservation leaves much to be desired—the bones of the head of the one side very largely obscure the outlines of those of the other, and no details of the skull-roof are clearly shown. The other specimens are similarly ill-preserved with regard to detail.

As may be seen in the holotype (see figure), the form is extremely slender and the fins well developed.

The head with opercular apparatus is about one-half as long again as deep, and the snout is rounded. The orbit lies far forward, as is usually the case. The jaws are long and slender and bear numerous incurved conical teeth along the outer margins, apparently with smaller teeth on the inner side. The maxilla, so far as one may judge, is of the usual Palæoniscid form, with a slender bar under the orbit and a deep posterior portion beneath the upper limb of the preoperculum. The suspensorium was very oblique, as one may see from the slope of the opercular bones. The operculum is about twice as deep as broad, while the preoperculum has the usual expanded triangular limb over the maxilla and a narrow lower bar behind it. The short anterior branchiostegal rays are very broad, but the number of rays in the series cannot be established, nor can the form of the suboperculum be made out.

The pectoral girdle is not well preserved in any specimen, but it appears to be strongly developed with a large post-temporal bone and a deep supracleithrum, which is ornamented with a series of V-shaped ridges (P.16380).

The dorsal, ventral, and anal fins have noticeably long bases, and the fin-rays are relatively stout, distantly jointed, and distally dichotomized. No fulcra, save those on the upper margin of the tail, can be seen.

Only the bases of the pectoral fins are preserved, but these show that the rays were numerous.

The ventral fins are triangular, their maximum height in the holotype being rather less than the length of their bases, which is 7 mm. Their origin is midway between the pectoral and anal fins, and the number of rays is about thirty-two. The dorsal fin is approximately as long as the ventrals, but slightly higher and with a few more rays. Its origin is at the middle point of the back, a little behind the level of the commencement of the ventrals.

The triangular anal fin lies completely behind the level of the dorsal, and the length of its base is only three-quarters as long, but equal to one and a half times its own height. It comprises upwards of twenty-five rays.

The heterocercal tail is extremely long, powerful, and deeply cleft, with the upper lobe slightly the longer. The length of this fin from its root to the tip of the upper lobe is contained not more than three and a half times in the total length of the fish. The rays are numerous, but their exact number cannot be ascertained: those of the lower lobe are obviously the stouter. The fulcral ridge-scales along the dorsal margin of the upper lobe are well developed; the first two or three are stout, but thereafter they become long and slender and towards the tip extremely numerous.

The squamation, except for the series of lancet-shaped scales covering the caudal body-extension, is very thin and ill-preserved. So far as one can see, it is uniform, and the individual scales seem to be deeply overlapped and rounded. Fine concentric lines of growth are to be seen in P. 16380.

Impressions of the internal skeleton are visible underneath the body-scales. From the level of the origin of the dorsal fin to the root of the tail there are about twenty neural arches, which are fairly long and stout with the spines fused to the pedicles; the hæmal arches are similar and directly opposed. Towards the tail the spines become longer and more inclined to the axis. There are no traces of ossification in the notochordal sheath.

The radials of the dorsal fin are stout and of moderate length, and at their articulation with the dermal rays they are somewhat expanded (P. 16381). There are approximately fifteen under the anterior half of the fin and therefore about thirty in all, rather fewer than the rays (P. 16383).

Remarks.—This species, which is named in honour of Professor T. D. A. Cockerell, is easily distinguished from the five species already described (see A. S. Woodward, 1891, Catal. Fossil Fishes B.M. ii. pp. 523–6; R. H. Traquair, 1911, Mém. Mus. roy. Hist. nat. Belg. v. p. 11) by its elongated form and the size and position of its fins.

XXXIX.—*Tectibranchs and Nudibranchs on the South Coast of Cork.* By Professor Louis P. W. Renouf, University College, Cork, I.F.S.

One of the most noticeable phenomena at Lough Ine this spring has been the large number of *Pleurobranchus* (*Oscanius*) *membranaceus* (Montagu) spawning along certain parts of the shore, many of them so high up that they were exposed at low water. This is the more remarkable from the fact that during nine years only three specimens have been seen in shallow water in the Lough, and the same number taken in the dredge.

The occurrence of four previously unrecorded species of Nudibranchs, some of them in considerable numbers, brings the total number of species recorded from Lough Ine and Barloge Creek to thirty-six :—

Limopontia capitata (O. F. Müller), *Elysia viridis* (Montagu), *Calma* (*Eolis*) *glaucoides* (Alder & Hancock), *Æolidia papillosa* (L.), *Favorinus albidus* (*Eolis alba*) Iredale & O'Donoghue, *Facelina curta* (*Eolis drummondi*) (Alder & Hancock), *F. longicornis* (*E. coronata*) (Montagu), *F. punctata* (Alder & Hancock), *Tergipes despectus* Johnston, *Eubranchus* (*Galvania*) *tricolor* Forbes, *E. pallidus* (*Eolis picta*) (Alder & Hancock), *Galvania farrani* (Alder & Hancock), *Coryphella* (*Eolis*) *rufibranchialis* (Johnston), *C. lineata* (Loven), *Eolis angulata*, *Idulia* (*Doto*) *pinnatifida* (Montagu), *Janolus* (*Antiopa*) *cristata* (Delle Chiaje), *J.* (*A.*) *hyalina* (Alder & Hancock), *Armina* (*Pleurophyllidia*) *loveni* (Bergh), *Ancula cristata* (Alder), *Goniodoris nodosa* (Montagu), *G. castanea* Alder & Hancock, *Onchidorus fusca* (O. F. Müller)=*Lamellidoris bilamellata*, *Atalodoris pusilla* (Alder & Hancock), *Acanthodoris pilosa* (Abildgaard), *Palio lessoni* (d'Orbigny) =*Polycera ocellata*+*P. lessoni*, *Polycera quadrilineata* (O. F. Müller), *Euphurus* (*Triopa*) *claviger* (O. F. Müller), *Ægires punctilucens* (d'Orbigny), *Rostangia rufescens* Iredale & O'Donoghue=*Doris coccinea* Alder & Hancock, *Jorunna tormentosa* (Cuvier)=*Doris johnstoni* Alder & Hancock, *Archidoris britannica* (Johnston)= *Doris tuberculata* Cuvier, *A. flammea* (Alder & Hancock), *A. stellifera* Vayssière=*Doris testudinaria* Risso, *Duvaucelia* (*Tritonia*) *plebeia* (Johnston), *D.* (*T.*) *lineata* (Alder & Hancock).

The nomenclature used is that of the Plymouth Fauna List, Second Edition, 1931.

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No. 82. OCTOBER 1934.

XL.—*The Percy Sladen and Godman Trusts Expedition to the Islands in the Gulf of Guinea, October* 1932–*March* 1933.—III. *Micro-Lepidoptera.* By EDWARD MEYRICK, B.A., F.R.S.

I HAVE been entrusted with the determination of the Plume Moths and Micro-Lepidoptera taken by Mr. W. H. T. Tams during his visit to West Africa on behalf of the British Museum. The following list includes 37 species, of which number 13 are described as new. There were also a few specimens whose condition did not admit of accurate specific determination.

Orneodidæ.

Orneodes atomoclasta, sp. n.

♂♀. 9 mm. Head, thorax white. Palpi with appressed scales, white, base of terminal joint fuscous. Forewings white; edges of four fasciæ indicated by some minute black specks and slight fuscous suffusion, second and third (antemedian and median) most perceptible: cilia white. Hindwings white; markings similar, but further from base.

São Tomé, Nov. 18; 2 ex. The specimens (one defaced) are not in condition to allow of more accurate description, but are recognizable.

Pterophoridæ.

Trichoptilus congrualis Walk. xxx. p. 943.

Annobon, Nov. 16; 2 ex.

Xyroptila tectonica Meyr., Suppl. Ent. 46 (1914).

Principe I., Dec. 10; 1 ex.

Platyptilia toxochorda, sp. n.

♂. 15–17 mm. Head, thorax blackish. Palpi obliquely ascending, blackish, base and tip white. Forewings cleft to ⅔, lobes rather broad, second considerably expanded posteriorly, termen of first sinuate, hardly oblique, of second very obliquely bisinuate; blackish-fuscous; six or seven very minute whitish costal strigulæ between base and cleft; a short fine white elongate mark on costa just beyond cleft; two or three very fine whitish transverse strigulæ above and below base of cleft; a very fine slightly irregular white transverse line on first lobe near apex, followed by a narrow blackish spot in disc, termen beyond this more fuscous, on second lobe a similar line incurved and followed by similar colouring on upper half, but obsolete on lower half: cilia on termen greyish with basal half blackish, within cleft and on dorsum pale brownish-ochreous, on dorsum with two dark fuscous scale-teeth. Hindwings dark fuscous; third lobe less than half first, very slender; cilia greyish, a dark fuscous subbasal line, on dorsum of third lobe a rather small triangular dark fuscous scale-tooth just before apex.

Principe I., Dec. 22; São Tomé, Nov. 9; 2 ex. Nearly allied to *citroleuca* Meyr. from Assam, but distinct by the incurved white line on second lobe of forewings, and absence of white markings in cilia.

Platyptilia brachymorpha Meyr., Tr. Ent. Soc. Lond. 1888, p. 240.

Principe I., Dec. 21; 1 ex.

Platyptilia molopias Meyr., Journ. Bomb. Nat. Hist. Soc. xvii. p. 135 (1906).

São Tomé, Oct. 29–Nov. 15, 3 ex.; Fernando Po, Moka, Oct. 28–Nov. 3, 1 ex.

Platyptilia infesta, sp. n.

♂♀. 25–26 mm. Head, thorax blackish-fuscous, an ochreous-whitish marginal streak on each side of metathorax. Palpi moderate, porrect, second joint much expanded with rough scales, terminal joint short, obtuse, dark fuscous, terminal joint and apex of second mixed whitish. Forewings cleft to $\frac{3}{5}$, lobes rather narrow, termen oblique, of first slightly sinuate, of second rather strongly, its apex prominent; blackish-fuscous; a slight indistinct elongate whitish costal mark on middle of first lobe, sometimes a few scattered minute whitish scales on this lobe: cilia blackish-grey, on termen grey on outer half, on dorsum a large triangular prominence before base of cleft and smaller tooth beyond it, cilia sometimes mixed whitish-ochreous round these. Hindwings dark grey, third lobe moderate, nearly $\frac{2}{3}$ of first; cilia grey, on dorsum of third lobe with a basal course of dense black scales from base to middle, expanded on a basal patch and forming a strong elongate-triangular median patch.

São Tomé, Aug. 5 and Oct. 30–Nov. 17; 7 ex. Nearest *strictiformis* Meyr. from Uganda.

Alucita niveodactyla Pag., Zoologica, xxix. p. 240.

Principe I., Dec. 10; 1 ex.

Exelastis crepuscularis Meyr., Ann. Transv. Mus. ii. p. 4, pl. ii. fig. 2.

São Tomé, Nov. 24; 1 ex.

Tortricidæ.

Tortrix prionistis Meyr., Exot. Micr. iii. p. 457 (1928).

São Tomé, Oct. 28–Nov. 24; 48 ex. The male has a large expansible tuft of yellow-brownish hairs rising from base of fore femora above, not mentioned in my description.

Tortrix dinota Meyr., Exot. Micr. ii. p. 168 (1918).

Principe I., Dec. 19–20; 2 ex.

Tortrix isotetras, sp. n.

♀. 18 mm. Head, palpi, thorax ferruginous-brownish. Forewings elongate-oblong, costa anteriorly moderately arched, posteriorly nearly straight, termen faintly sinuate, little oblique; light ferruginous-ochreous, a few scattered dark grey scales; edge of basal patch indicated by a straight oblique thick dark ferruginous streak mixed dark grey, preceded by some grey suffusion; central fascia moderate, grey, enclosed by two similar parallel streaks; a fourth also similar and parallel from costa at $\frac{2}{3}$ to near tornus: cilia pale ferruginous-ochreous. Hindwings grey; cilia grey-whitish, a grey subbasal shade.

Fernando Po, Moka, Nov. 2; 1 ex.

Eucosmidæ.

Spilonota algosa Meyr., Journ. Bomb. Nat. Hist. Soc. xxi. p. 854 (1912).

São Tomé, Nov. 18; 2 ex. (♀). These show no tangible difference from my series, which is from Assam, except that the veins of the hindwings are not appreciably darkened. The species may be attached to fruit-trees, as several allied forms are, and hence capable of introduction.

Crocidosema plebeiana Zell., Isis, 1847, p. 721.

São Tomé, Nov. 24; 1 ex.

Eucosma sphalerodes, sp. n.

♂ 12 mm., ♀ 13–14 mm. Head grey, variably suffused ochreous-whitish or greyish-ochreous, or tinged bluish on crown. Palpi grey suffused darker, internally ochreous-whitish. Thorax grey partially suffused dark fuscous. Forewings rather elongate, somewhat dilated, costa gently arched, without fold, termen little oblique, sinuate-indented in middle; 7 and 8 sometimes stalked, variable (about equally) on opposite sides; grey, irregularly and suffusedly mixed dark fuscous; costa slenderly blackish, with short oblique irregularly paired whitish strigulæ, a single larger strigula before apex; an ill-defined quadrate antemedian dorsal blotch of dark suffusion (representing basal patch), posterior edge distinct and more or less edged whitish suffusion; slender oblique blackish central fascia more or less developed, at least on upper half; ocellus obscurely indicated by thick anterior and narrow posterior suffused leaden bars: cilia grey slightly tinged whitish, with two strong dark grey shades. Hindwings 3 and 4 very long-stalked; dark grey, veins darker; cilia grey.

Principe I., Dec. 22; 6 ex. An obscure insect, somewhat recalling the European *tetraquetrana* Haw., and resembling some of the allied European species in the specified variability of neuration, but on the other hand lacking the costal fold of forewings. A male example from São Tomé, Oct. 28, has the ground-colour of forewings light grey, and all the markings stand out more clearly, the dark dorsal blotch and contrasting white suffusion especially well marked, but the details are essentially similar and structure identical throughout, 7 and 8 of forewings stalked for half their length; in my judgment it is certainly the same species.

Eucosma tonitrualis, sp. n.

♂. 17mm. Head ashy-grey, face darker, crown suffused white posteriorly towards middle. Palpi dark grey. Thorax blackish-grey, apical half of tegulæ white. Abdomen dark grey, anal tuft of pale grey expanded hairs. Forewings elongate, gradually dilated, costa slightly arched, without fold, apex obtuse, termen somewhat obliquely rounded; grey suffusedly mixed fuscous; a few scattered whitish scales on or near costa; a white speck on end of cell; an elongate-triangular white blotch along posterior half of dorsum, reaching ⅓ across wing, confluent on dorsum with a suffused spot preceding it; four subconfluent white dots on median third of termen: cilia whitish, with two suffused fuscous shades (imperfect). Hindwings with tornal area expanded, but with a deep semicircular terminal excision above tornus, 3 and 4 stalked; rather dark grey; an elongate bolt-shaped black androconial spot in middle of disc, an oblique tuft of whitish hairs partially covered by long whitish scales from beneath costa towards base partially projecting over this: cilia light grey, on termen from apex to concavity almost aborted.

São Tomé, Nov. 5; 1 ex. Possibly related to *melanaula* Meyr., in which a similar structure of hindwings in ♂ is indicated in a far less developed form.

Eucosma metamorphica Meyr., Exot. Micr. iii. p. 439 (1928).

Principe I., Dec. 22; 2 ex.

Cosmorrhyncha ocelliferana Walk. xxviii. p. 408.

Principe I., Dec. 10–31; 2 ex.

Polychrosis incultana Walk. xxviii. p. 316.

Principe I., Dec. 19–22; 3 ex.

Lobesia œolopa Meyr., Journ. Bomb. Nat. Hist. Soc. xvii. p. 976 (1907).

São Tomé, Oct. 28–Nov. 15; 2 ex.

Argyroploce batrachopa Meyr., Proc. Zool. Soc. Lond. 1908, p. 718.

São Tomé, Oct. 30; 1 ex.

Argyroploce purpurissatana Kenn., Iris, xiii. p. 252 (1900).

Principe I., Dec. 22; 1 ex., probably a local form of this species (which occurs in Africa as well as in Asia), but with the posterior blotch less globular.

Argyroploce decidua, sp. n.

♂♀. 18–19 mm. Head, thorax light greyish, crest suffused dark brown. Palpi dark grey, towards base whitish-grey. Forewings rather elongate, posteriorly dilated, costa gently arched, termen straight, rather oblique; ochreous-whitish, some scattered dark grey strigulæ, edge of basal patch marked by some of these, angulated in middle, marked black on lower half; markings dark fuscous; central fascia rather broad, oblique, expanded downwards, terminating on fold; a large transverse-oval blotch just before termen, reaching from near costa to opposite termination of central fascia, some slight blackish marking in disc between these; three small spots on costa posteriorly, one at apex, and a terminal series of dots: cilia ochreous-whitish, partially tinged grey. Hindwings grey, a darker terminal line; cilia light grey.

São Tomé, Nov. 2–30; 2 ex. Allied to *purpurissatana*.

Argyroploce astrogenes Meyr., Exot. Micr. iv. p. 485.

Principe I., Dec. 19–22; 2 ex. These examples, in indifferent condition, are males, and the hind tibiæ are densely tufted towards apex with grey hairs. The original example, from Madagascar, is a female, and, though similar superficially, further confirmation is necessary.

Argyroploce albifacies Wals. Swinh., Cat. Oxf. Mus. ii. p. 570 (*albifascies*).

São Tomé, Nov. 18 ; 1 ex. A Ceylon insect, doubtless artificially introduced.

Argyroploce doctrinalis, sp. n.

♂♀. 18–20 mm. Head, palpi ochreous-brownish. Thorax ochreous-brownish, suffused grey posteriorly. Forewings elongate, slightly dilated posteriorly, costa gently arched, termen slightly sinuate, little oblique ; rather dark ochreous-brown suffusedly mixed dark grey ; costal edge dark fuscous, on posterior half with five pairs of short indistinct whitish strigulæ emitting short blue-leaden marks ; a small suffused white apical spot ; ocellus represented by narrow central pale yellow suffusion limited posteriorly by a short silvery-grey streak preceded by two blackish dots and followed by an excurved whitish streak ; a fine blackish terminal line : cilia light grey-yellowish, base and tips white. Hindwings dark grey ; cilia grey, round apex tinged whitish.

São Tomé, Oct. 28–Nov. 2 ; 2 ex.

Argyroploce gutturalis, sp. n.

♂. 12 mm. Head, palpi, thorax dark fuscous. Forewings somewhat elongate-triangular, costa gently arched, termen straight, little oblique ; dark fuscous, markings blackish-fuscous, extreme costal edge slightly touched whitish between them ; some irregular marking indicating edge of basal patch, obtusely angulated in middle ; central fascia about middle of wing, little oblique, rather broad, irregular, somewhat angulated in middle ; a small spot on costa preceding this, and several posteriorly : cilia dark grey. Hindwings grey ; dorsal margin irregularly folded, a deep subdorsal groove including a broad streak of blackish suffusion ; cilia whitish-grey, a grey subbasal shade. Hind tibiæ with dense grey tuft above towards apex.

São Tomé, Oct. 29 ; 3 ex. The examples are in indifferent condition, but seem recognizable by the characters given. A female specimen from Principe I., Dec. 10, the posterior part of forewings partially mixed ochreous-whitish and much suffused blue-leaden, lacking the secondary sexual characters, is, I think, certainly the other sex of this species, in better condition; an upwards-oblique blackish streak from termen below middle reaching half-way to costa stands out distinctly, but is traceable also in ♂.

Gelechiadæ.

Brachmia ditemenitis, sp. n.

♂. 19 mm. Head, thorax fuscous, face pale greyish-ochreous. Palpi fuscous, terminal joint ochreous-whitish. Forewings elongate, slightly dilated, costa gently arched towards extremities, termen nearly straight, somewhat oblique; 9 almost connate with 7; rather dark fuscous with faint purplish tinge; a slender finely attenuated ochreous-whitish dorsal streak from base to near tornus; two dark-edged discal blotches outlined with whitish, first at ⅓, triangular, base near dorsum, apex above middle, second on end of cell, transverse-oblong; a small indistinct whitish dot on costa before ¾; a fine dark fuscous terminal line: cilia grey, base whitish. Hindwings light grey; cilia whitish-grey, a grey subbasal shade.

Fernando Po, Moka, Jan. 28–Feb. 3; 1 ex. Allied to *convolvuli* Wals.

Metachandidæ.

Metachanda citrodesma Meyr., Ann. Transv. Mus. iii. p. 74 (1912).

♂. 9–13 mm. Head, thorax leaden-grey. Palpi dark grey, tip whitish, scales of second joint expanded above towards apex. Forewings dark leaden-grey, obscurely mixed dark fuscous; discal stigmata forming small obscure blackish spots: cilia dark grey. Hindwings and cilia grey.

♀. Very variable, but always with yellow markings more or less developed as in original description; face sometimes yellow; scales of second joint of palpi not expanded; antennæ with two narrow bands towards apex and extreme tip whitish; forewings with anterior yellow fascia very variable, sometimes narrow and whitish anteriorly, sometimes broadly expanded in disc, edged blackish or posterior part of expansion replaced by blackish sometimes irregularly marked yellow; yellow discal spot on end of cell variably developed, or replaced by blackish, sometimes connected with dorsum by a blackish fascia, in one example a dorsal blotch of white suffusion between this and preceding fascia, ground-colour of wing between anterior and posterior fascia sometimes rather light shining leaden-grey; posterior yellow fascia also very variable in development, rarely narrow and entire, usually reduced to a variable costal spot and some scattered scales; usually two indistinct yellowish dots on costa towards apex: cilia grey, a dark fuscous antemedian shade more or less developed. The extreme form is attained, however, by the single female from Principe I., which expands 10 mm., and has the anterior fascia and discal spot confluent into a broad yellow transverse band, occupying more than ⅓ of wing, and containing two blackish spots near its posterior margin; I am, however, satisfied that it is conspecific with the others.

São Tomé, 14 ex. (4 ♂ (one unfortunately broken in transit), 10 ♀), Oct. 29–Nov. 18; Principe I., 1 ♀, Dec. 21. Described originally from a single female from Transvaal; three others (all ♀) subsequently obtained from Nyasaland and Natal.

Œcophoridæ.

Theatrocopia roseoviridis Wals., Trans. Ent. Soc. Lond. 1897, p. 43, pl. ii. fig. 6.

Principe I., Dec. 21–22; 3 ex. In one of these, by a curious abnormality, in the right forewing vein 7 is remote from 8 and very shortly stalked with 6, the structure of the left forewing remaining normal. The second example is an equally interesting colour variety, having the light greenish basal area of forewings finally terminated on costal half by an oblique line about middle of wing, but beneath this connected by a thick bar with the green dorsal blotch, so as to enclose a semicircular blotch of ground-colour suffused brownish except on circumference, the terminal half of wing more suffused whitish. The third (a female) has forewings whitish with scattered grey-greenish scales, the whole basal area and dorsal ⅔ obscurely suffused dull greenish-grey. Taken in conjunction with the other specimens known to me, I think these examples prove that *elegans* Wals. is only a synonym of *roseoviridis*, reducing the genus to a single variable species.

Heliodinidæ.

Stathmopoda holothecta, sp. n.

♂♀. 22–25 mm. Head ferruginous-yellowish. Palpi pale ochreous, base dark fuscous. Thorax ferruginous to dark brown, a broad yellowish (♂ sometimes whitish) median band. Forewings widest near base, thence attenuated throughout to acute apex; brown, sometimes tinged fulvous or fuscous; two yellow dorsal blotches (in ♂ white or whitish), rather broadly edged dark fuscous suffusion, reaching $\frac{3}{4}$ across wing, first at $\frac{1}{4}$, inwards-oblique, irregular, preceded dorsally by more or less developed ferruginous-orange suffusion, second about middle, subtriangular or suboval; some undefined yellowish suffusion about $\frac{3}{4}$: cilia grey. Hindwings grey; cilia grey, in ♂ more or less tinged yellowish towards base. In one female the thorax and forewings are almost wholly suffused dark fuscous, the blotches obliterated, some white basal suffusion, especially on dorsum.

São Tomé, Oct. 29–Nov. 18; 13 ex. In the exceptionally large size, and in colour and markings, this species hardly differs, if at all, from *principalis* Meyr. from the Comoro Islands, but in that insect the forewings are (exceptionally for the genus) nearly parallel-sided throughout and only pointed near apex, a very remarkable difference; the hindwings are also broader and darker.

Hyponomeutidæ.

Ethmia spyrathodes Meyr., Exot. Micr. ii. p. 552 (1922).

São Tomé, Oct. 30–Nov. 18; 4 ex.

Gracilariadæ.

Parectopa onychota Meyr., Proc. Zool. Soc. Lond. 1908, p. 735.

São Tomé, a large example (10 mm.) in damaged condition, with unusually large black apical mark.

Plutellidæ.

Plutella maculipennis Curt., Guide, p. 186.

São Tomé, Nov. 1; 1 ex.

Lyonetiadæ.

Opogona antiarcha, sp. n.

♀. 15–16 mm. Head smooth, purplish-fuscous, face whitish, fillet silvery. Palpi fuscous, interiorly whitish. Thorax purplish-fuscous, posterior edge pale yellowish towards middle. Forewings light yellow; a rather irregular purplish-fuscous streak along basal fifth of costa; larger apical half of wing violet-bronzy-brown, edge running from costa before middle rather obliquely outwards, somewhat biconvex on upper ⅔, indistinctly dark brown: cilia greyish. Hindwings rather dark grey; cilia grey.

São Tomé, Oct. 28–Nov. 18; 5 ex.

Decadarchis dracaenura, sp. n.

♂. 18 mm. Head ochreous-whitish, face mixed grey. Palpi dark grey, interiorly whitish. Thorax grey-whitish, an ochreous central stripe, shoulders suffused dark grey. Abdomen on segments 5–8 with paired dorsal slender erectile scale-tufts. Forewings elongate, costa moderately arched, apex pointed, termen very obliquely rounded; ochreous-whitish, rather thinly but coarsely irrorated fuscous; dark fuscous dots or small spots, viz. one on base of costa, two dorsal and subdorsal near base, one costal at ¼, two costal at middle and ¾ and two others subcostal somewhat before these, two discal at ⅓ and ⅔ and one dorsal midway between these, one tornal and one apical: cilia ochreous-whitish, a basal series of grey spots and median and subapical grey shades more or less developed. Hindwings whitish-grey, some ochreous suffusion on tornal area (probably sexual); cilia whitish.

São Thomé, Oct. 28–30; 3 ex. Allied to *molynta* Meyr. from the Seychelles.

Tineidæ.

Ptychoxena tephrantha Meyr., Exot. Micr. i. p. 616 (1916).

Principe I., Dec. 12; 1 ex.

XLI.—*Two new Species of the Cestode Genus* Bertiella, *with a Note on the Presence of Uterine Pores.* By H. A. Baylis, M.A., D.Sc., Department of Zoology, British Museum (Natural History).

Baer (1927), in his revision of the family Anoplocephalidæ, restricts the genus *Bertiella* Stiles and Hassall to two species occurring in Primates, and erects a genus *Prototænia* for the forms found in Marsupials and Insectivora. The distinctions given by Baer between these two genera appear to be very slight, and most of them are not mutually exclusive, as the following tabulation of them will show :—

	Bertiella.	*Prototænia.*
Size	" Medium."	" Variable."
Scolex	Globular.	With more or less pedunculate suckers.
Genital pores	Irregularly alternating.	Irregularly alternating.
Genital ducts	Pass dorsally to excretory vessels and nerve.	Pass dorsally to excretory vessels and nerve.
Testes	Numerous, forming a continuous field limited by the excretory canals.	Numerous [apparently limited by the excretory canals].
Cirrus-sac	Not highly developed. Contains a seminal vesicle.	Highly developed; sometimes has a retractor muscle. [May or may not contain a seminal vesicle.]
Ovary and vitelline gland.	Situated in poral half of segment.	Situated in poral half of segment.
Uterus	A transverse tube, not extending beyond the excretory canals.	A transverse tube, becoming saccular, passing the excretory canals on the ventral side.
Eggs	With pyriform apparatus.	With more or less well developed pyriform apparatus.

It will be noted that, according to Baer, the uterus in *Prototænia* crosses the lateral excretory canals on the ventral side. In the two species to be described below the uterus crosses the excretory canals on the same side as the genital ducts, *i. e.*, dorsally. The same is true of specimens determined by the writer as *Bertiella studeri* (Blanchard), *B. plastica* (Sluiter), and *B. elongata* (Fuhrmann). The writer is inclined to the view that the genus *Prototænia* cannot at present be distinguished from *Bertiella*, and prefers to regard it as a synonym of the latter genus.

Bertiella kapul, sp. n. (Figs. 1–3 & 8.)

This species was collected by Dr. A. Gilroy from the intestine of a spotted cuscus (*Phalanger maculatus krämeri*) * captured on the island of Manus, Admiralty group. For the material the writer is indebted to Dr. T. C. Backhouse, of the Public Health Laboratory, Rabaul, New Britain.

This form is evidently very closely related to *B. rigida* (v. Janicki, 1906), a species recorded from *Phalangista* sp. in New Guinea. Unfortunately the scolex of *B. rigida* is unknown, and v. Janicki's description, though extremely detailed, was based on an incomplete specimen.

The present material is also fragmentary, but consists of portions of a considerable number of specimens, and includes several scolices. The longest fragment, which is incomplete at both ends, measures about 72 cm. in length. Another and more contracted specimen, which has a scolex but is incomplete posteriorly, measures about 66 cm. The length of a complete worm may therefore be assumed to be not less than 70 cm., and probably on the average considerably more than this. The maximum width of the strobila is about 6 mm. Its dorso-ventral thickness is very variable, according to the state of contraction of the specimen. Strongly contracted individuals are almost cylindrical. All the segments are much broader than long, and their posterior borders are very prominent.

The scolex (figs. 1 & 2) is relatively very large, having a diameter of about 2·5–3 mm. The suckers are pedunculate and have the form of widely open grooves rather than cups. Segmentation appears to begin immediately behind the scolex.

The internal anatomy agrees closely with the account of *B. rigida* given by v. Janicki. As in that species, the medullary parenchyme occupies only a small proportion (nowhere more than about one-third) of the dorso-ventral thickness. The cortical parenchyme is very thick, and about the inner half of its thickness is occupied by the numerous large bundles of longitudinal muscle-fibres.

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* The determination of the host was made by Mr. M. A. C. Hinton, F.R.S., of the British Museum (Natural History), on the basis of a skin and skull kindly sent by Dr. Backhouse.

The ventral longitudinal excretory canals and their transverse commissures are relatively enormously wide. In close apposition to the former, on their inner sides, are the narrow dorsal longitudinal canals, and on their outer sides the longitudinal nerves. The irregularly alternating genital ducts pass dorsally to both canals and the nerve of the poral side.

Fig. 1.

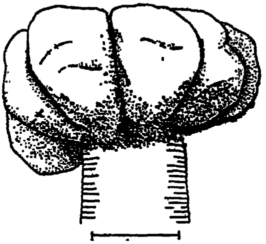


Fig. 2.

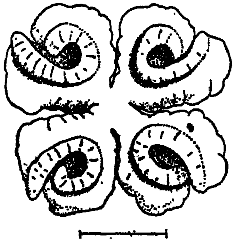
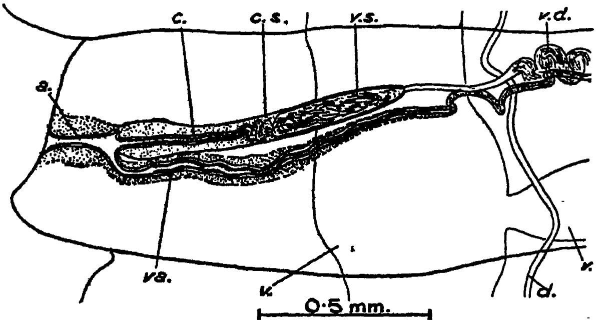


Fig. 3.



Bertiella kapul, sp. n.

Fig. 1.—Scolex; dorso-ventral view.
Fig. 2.—Scolex; apical view.
Fig. 3.—Left portion of a mature segment (semi-diagrammatic), showing the arrangement of the genital ducts. *a.*, atrium; *c.*, cirrus; *c.s.*, cirrus-sac; *d.*, dorsal excretory canal; *v.*, ventral excretory canal, and *v.'*, its transverse commissure; *va.*, vagina; *v.d.*, vas deferens; *v.s.*, vesicula seminalis.

The genital ducts open into a muscular atrium about 0·1–0·2 mm. deep. The cirrus-sac (fig. 3, *c.s.*) is of an elongate shape, somewhat tapering towards its inner end, and measures in mature segments about 0·6–0·9 mm. in length and 0·1–0·12 mm. in width at its widest part, which is usually near its opening into the atrium. It extends as far as, and usually partly across, but never beyond, the ventral excretory canal. Its inner end is occupied by a large internal seminal vesicle. The cirrus, which occupies the outer end of the sac, is composed of two regions, the distal portion straight and the proximal portion coiled. The whole of the cirrus is lined with long cilia, and covered, outside its muscular coats, with "prostatic" cells. The vas deferens, though dilated and much coiled proximally, becomes relatively straight and narrow where it crosses the excretory canals and enters the cirrus-sac. It does not show the fusiform swelling indicated in this region by v. Janicki in *B. rigida*, or rather, perhaps, this swelling (the seminal vesicle) is included within the cirrus-sac. The distal portion of the vagina runs parallel to and behind the cirrus-sac, and is a wide, comparatively straight duct. Proximally it becomes more convoluted, but is without a receptaculum seminis. The vagina is lined throughout with cilia, except for a short distance near its opening into the atrium. Its muscular coats are relatively thin, and there is an external investment of glandular cells.

There are about 85–100 testes in each mature segment. These extend in an unbroken series, two or three testes deep in most places, across the anterior part of the segment from the excretory canals of one side to those of the other. The details of the female organs are almost precisely as described by v. Janicki for *B. rigida*. The ovary is situated somewhat on the poral side of the middle of the segment, and is composed of two fan-shaped masses of lobes joined ventrally by an isthmus. It measures about 1·3 mm. transversely when fully developed. The vitelline gland is rosette-like and multilobate, and lies behind and dorsally to the median isthmus of the ovary. It measures 0·3–0·4 mm. in diameter. The uterus is at first a transverse tube extending laterally as far as, but rarely beyond, the excretory canals. This later becomes rather irregular in outline, but does not give off regular series of pockets. At its ends it ultimately opens to the exterior by two definite pores near the posterior angles of the segment as described below.

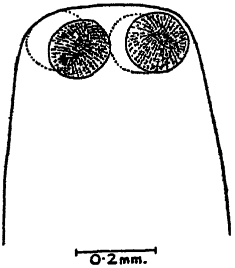
The eggs are subglobular and have a maximum outside diameter of about 0·032–0·035 mm. The onchospheres measure about 0·0125 mm. in diameter and the embryonic hooks 0·0056 mm. in length. There is no pyriform apparatus.

Bertiella anapolytica, sp. n. (Figs. 4–7.)

This species was obtained from the colon of *Rattus rattus brevicaudatus* at Balige, Sumatra, and the material was kindly forwarded to the writer by Dr. C. Bubberman, Director of the State Veterinary Institute, Buitenzorg, Java.

The length of a complete specimen is slightly more than 16 cm. The maximum width of the strobila is about 5 mm., and it is relatively thin dorso-ventrally. The diameter of the scolex (fig. 4) is about 0·4–0·45 mm. The suckers are not prominent and are relatively small, having a diameter of 0·15–0·17 mm. The scolex is not set off from the strobila, the anterior portion of which increases gradually in width. Definite segmentation does not begin for a distance of about 1–1·5 mm. from the anterior end. All the segments are considerably wider than long.

Fig. 4.

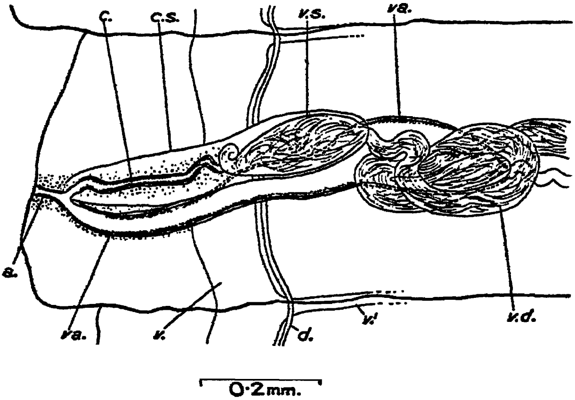


Bertiella anapolytica, sp. n. Scolex ; dorso-ventral view.

The subcuticular layer is well developed and contains large numbers of glandular cells. The musculature is not very highly developed. The longitudinal muscles are arranged in two rather indefinite layers, the inner layer consisting of rather larger bundles of fibres than the outer. The medullary parenchyme occupies about half of the dorso-ventral thickness.

The genital pores are irregularly alternating, and the ducts pass dorsally to the excretory canals and nerve. The genital atrium is relatively small (about 0·05–0·1 mm. deep). The cirrus-sac (fig. 5, *c.s.*) measures about 0·5–0·65 mm. in length and 0·1–0·13 mm. in width at its widest part, which is towards the proximal end. It extends considerably beyond the excretory canals, and contains a large oval seminal vesicle. The cirrus is lined with cilia. The vas deferens is much coiled, and in mature segments is greatly distended with sperm. The distal portion of the vagina forms an elongate sac (fig. 5, *va.*), as wide as, or wider than, the cirrus-sac, and considerably longer. This sac opens into the atrium immediately behind the cirrus-sac, and at first runs parallel to the latter. Proximally, however, it bends slightly forward and passes ventrally to its inner end. The

Fig. 5.



Bertiella anapolytica, sp. n. Left portion of a mature segment (semi-diagrammatic), showing the arrangement of the genital ducts. *a.*, atrium; *c.*, cirrus; *c.s.*, cirrus-sac; *d.*, dorsal excretory canal; *v.*, ventral excretory canal, and *v.'*, its transverse commissure; *va.*, vagina; *v.d.*, vas deferens; *v.s.*, vesicula seminalis.

vaginal sac is lined with cilia which appear to be finer than those of the cirrus.

There are probably between fifty and sixty testes in a mature segment. These form an uninterrupted field across the anterior portion of the segment, limited by the excretory canals on either side. The testicular field is from one to two testes deep antero-posteriorly and from two to three deep dorso-ventrally. In the latter direction it occupies the whole thickness of the medullary parenchyme. The ovary lies towards the poral side of the middle of the segment, but slightly overlaps the middle line. It is of the usual fan-shaped form, and when fully developed has a width of about 0·9 mm. The vitelline gland appears to be rather diffuse.

The uterus is at first a simple transverse tube, extending beyond the excretory canals on either side. Like the genital ducts, it passs over the canals dorsally. Its blind extremities are directed towards the posterior angles of the segment, where, as will be described below, birth-pores are ultimately formed. The uterine tube soon begins to send out a number of anterior and posterior pocket-like extensions. Of these there are usually about twenty on each side of the main transverse tube, the anterior pockets being longer than the posterior. As the uterus expands the pockets merge into one another, so that ultimately the uterus becomes a large, irregularly lobulated sac. The eggs are spherical, and when fully formed have an outside diameter of 0·042–0·044 mm. They contain a simple pyriform apparatus which, in uterine eggs, does not possess horns. The outside width of the embryophore (*i. e.*, the large end of the pyriform apparatus) is 0·018–0·02 mm. The embryonic hooks measure about 0·007 mm. in length.

No member of the genus *Bertiella* appears hitherto to have been recorded from a rodent. The hosts of the ten species of *Prototænia* of which a comparative table is given by Baer (1927) are all Marsupials, with the exception of two species from *Galeopithecus*. The present form seems to be distinguishable from all the known species by the small size of its scolex, and does not agree with any of them in the combination of other characters (*e. g.*, size of cirrus-sac and number of testes).

On the Occurrence of Uterine Pores in Bertiella.

In some groups of segmented Cestodes a special uterine pore is of frequent occurrence. Among the Bothriocephalidea (Pseudophyllidea), for example, such a pore is usually present. In some genera of Tetrarhynchidea, and of those families of Tæniidea which are often classified together as the Tetraphyllidea, a birth-pore is not an unusual feature either as a permanent or as a temporary structure. Among the remaining families of Tæniidea (commonly known collectively as the Cyclophyllidea) birth-pores appear to have been observed only in certain

Fig. 6.

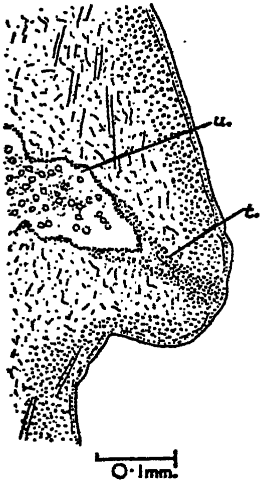
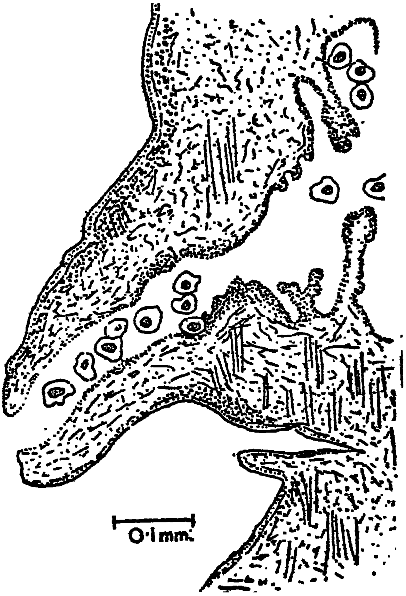


Fig. 7.



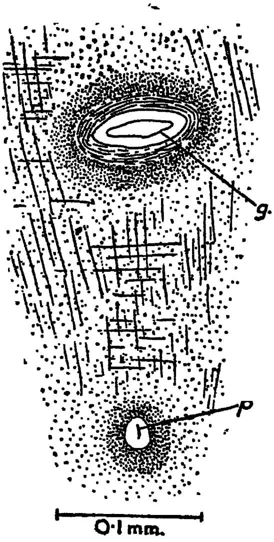
Bertiella anapolytica, sp. n.

Fig. 6.—Horizontal section through the posterior angle of a young gravid segment, showing (*t.*) the first appearance of a thickening of the parenchyme, destined to form a duct from the uterus (*u.*) to the exterior.

Fig. 7.—Horizontal section through the posterior angle of a gravid segment, showing the fully-formed uterine duct, with eggs passing out of the uterus.

Tetrabothriidæ and in the genus *Gyrocœlia* (fam. Acoleidæ). In the latter the ring-shaped uterus has a dorsal and a ventral pore in the middle line near the hinder border of the gravid segment. In the Tetrabothriidæ a column of cells may frequently be observed connecting the wall of the uterus with the dorsal subcuticular layer of the segment, and this apparently may ultimately acquire a lumen. In the Anoplocephalidæ no such structure, so far as the writer is aware, has hitherto been described.

Fig. 8.



Bertiella kapul, sp. n. Optical sagittal section through the lateral border of a segment, showing the genital pore (*g.*) and the uterine pore (*p.*) of the same side. The latter is closed by a cuticular plug.

It is therefore interesting to find that in the two species described above, and also in *Bertiella plastica* and *B. elongata*, a pair of birth-pores is developed in each gravid segment. The position of these pores, at the lateral and posterior angles of the segment, is different, but the manner of their formation appears to be the same as in the Tetrabothriidæ. The first sign of their development (fig. 6) is the appearance of a slight thickening of the parenchyme, containing many nuclei and running diagonally inwards from the subcuticular layer towards the extremity of the uterine tube. This thickening begins to appear, in *B. anapolytica*, soon after the beginning of the formation of pockets by the uterus. As the segments become older a fibrous core is gradually formed in the thickening. Ultimately (fig. 7) this acquires a lumen and a connection with the uterus, and forms a duct through which eggs may be seen escaping. In this way the last few segments are almost completely emptied of eggs before being detached from the strobila. Before oviposition the distal end of the duct is lined with an invagination of the external cuticle. This forms a conical plug having a narrow lumen—too narrow for the passage of eggs. In segments that have begun to shed their eggs the plugs are found to have disappeared, and it seems probable that they become detached and are pushed out when eggs begin to pass down the ducts.

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JANICKI, C. VON. 1906. "Die Cestoden Neu-Guinea's." Nova Guinea (Rés. de l'Exp. Sci. Néerland. à la Nouvelle-Guinée), Leiden, v. Zool., i. pp. 181–200, pls. vii.–x.

XLII.—*On the Structure of* Monograptus dubius (*Suess*).

By IAN COX, B.A., Sedgwick Museum, Cambridge.

[Plate XI.]

I. INTRODUCTION.

Graptolithus dubius (Suess), Ueber Bohmische Graptolithen, Haidinger's Abhandl. vol. iv. pt. iv. p. 115 & pl. ix. figs. 5 *a*, 5 *b*, 1851.

Monograptus dubius (Suess), G. L. Elles and E. M. R. Wood, 'Monograph of British Graptolites,' pp. 376–378, figs. 247 *a* & *b*, & pl. xxxvi. figs. 7 *a–d*, Pal. Soc. London, 1901–1918, with full bibliography.

The material on which the following observations are based was obtained by isolation from a small piece of bluish limestone from Gottland. This had been given by Professor C. Wiman to Dr. O. M. B. Bulman, who was good enough to hand it to the writer for investigation.

The limestone is labelled "Kronvall" (Gottland), the locality from which came similar material described by Wiman in 1893 [*], and is presumably from the same horizon (*i. e.*, layer C).

While this paper treats of the same material as Wiman [*] has considered, it is intended to supply further detail of the minute structure of *M. dubius* which is of interest in the light of work done since 1893 [†].

The technique employed for isolating specimens from the matrix, and their subsequent maceration and mounting, was the same as that used for *Climacograptus inuiti* Cox [‡], and need not be reiterated here. The isolated specimens, however, were not as well preserved as in the case of the *Climacograpti*, and the material far less in quantity. About fifty individuals, showing various stages in the ontogeny, were secured, and of them some thirty-five were worth mounting. There is no evidence of more than one species being present in the material. All figured specimens are preserved in the Sedgwick Museum, Cambridge, to the catalogue of which numbers in parenthesis refer.

II. ONTOGENY.

The Prosicula.—Many prosiculæ (*P* in text-figs.) were obtained, but for the most part were badly preserved. Two show the earliest stage, with no longitudinal threads. These (text-fig. 1) have a length of about ·35 mm. and a diameter of about ·10 mm. The *nema prosiculæ* [§] (text-fig. 1, *n*) is extremely short. The specimen illustrated in text-fig. 1 is distorted by preservation, and should normally have the characteristic bottle-shape. Text-fig. 2 shows a prosicula in which one longitudinal thread (*r*) has been produced. The other prosiculæ (text-figs. 3–7) do not show the orderly arrangement of primary threads which was so apparent in *Cl. inuiti* [||] and *Orthograptus*

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[*] C. Wiman, "Ueber *Monograptus* Geinitz," Bull. Geol. Inst. Univ. Upsala, vol. i. no. 2, 1893, pp. 113–117.

[†] The species was also shortly considered by G. Holm, "Gotlands Graptoliter," Bihang Till K. Sv. Vet. Akad. Handl. Band 16, Afd. iv. no. 7, p. 161, Taft. 1, figs. 18–26. Stockholm, 1890.

[‡] Ian Cox, "On *Climacograptus inuiti*, sp. nov., and its Development," Geol. Mag. lxx. 1933, p. 4.

[§] P. Kraft, "Ontogenetische Entwicklung und Biologie v. *Diplograptus* and *Monograptus*," Pal. Zeitschrift, Bd. vii. 1926, p. 223.

[||] Ian Cox, *loc. cit.* p. 5.

gracilis (Roemer) *, but it is possible to recognise six † of these primary threads, which fuse by pairs, giving three rods which pass up into the base of the nema (see sections 244–254, *r*, text-fig. 16). It might be noticed that the number is six, and not four, as described for *Orthograptus gracilis* and *Cl. inuiti*, although in the latter case, while macerated specimens show four fusing apically into two discrete threads, sections showed that at a certain stage there were three presentat the base of the nema ‡. But probably this only means that the fusions did not take place at the same level.

Although secondary longitudinal threads are subsequently intercalated between the primaries from the apertural margin of the prosicula, and pass out distally after running two-thirds of the length, it was not possible in this case to determine any order in their arrangement. In no case could the spiral band of the prosicula be seen. It is extremely unlikely that this was removed during maceration, because the specimens were very carefully watched during the process. That Kraft observed the structure in *Monograptus* sp. §, suggests that in this case it has either probably been removed prior to fossilization or in the isolation of specimens, rather than that it never was present. It might be mentioned that in specimens of *Cl. inuiti* the spiral band was not always visible. It seems that a slight increase in size (excluding growth in the nema) accompanies the development of the prosicula, but since there is little difference once all the longitudinal threads are added, it is possible that the unstrengthened prosiculæ may have shrunk.

The Metasicula (*M* or *s* in text-figs.) when fully grown does not exceed a length of 1·6 mm. Growth is normal, by the addition of growth layers round the periphery of the aperture. These layers wedge out laterally on the surface opposite to the virgella (text-fig. 8). The mode of production of the virgella differs slightly from that in *Cl. inuiti*. It is produced, after the metasicula has grown to a length of about ·30 mm., by a sudden proximal bending of the growth layers, the lines bounding which

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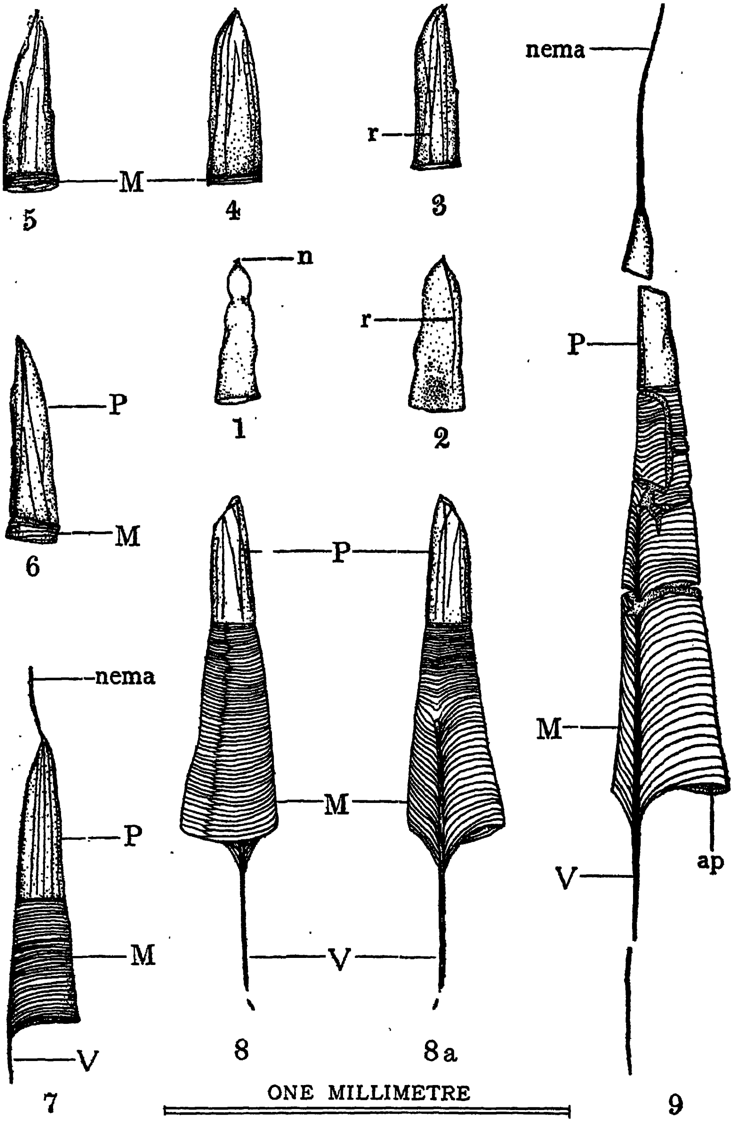
* P. Kraft, *loc. cit.* pp. 223–224.

† P. Kraft, *loc. cit*, p. 234, describes four, and rarely five, threads for *Monograptus* sp.

‡ Ian Cox, *loc. cit.* figs. 1–3, and Section 112, fig. 24 *b*.

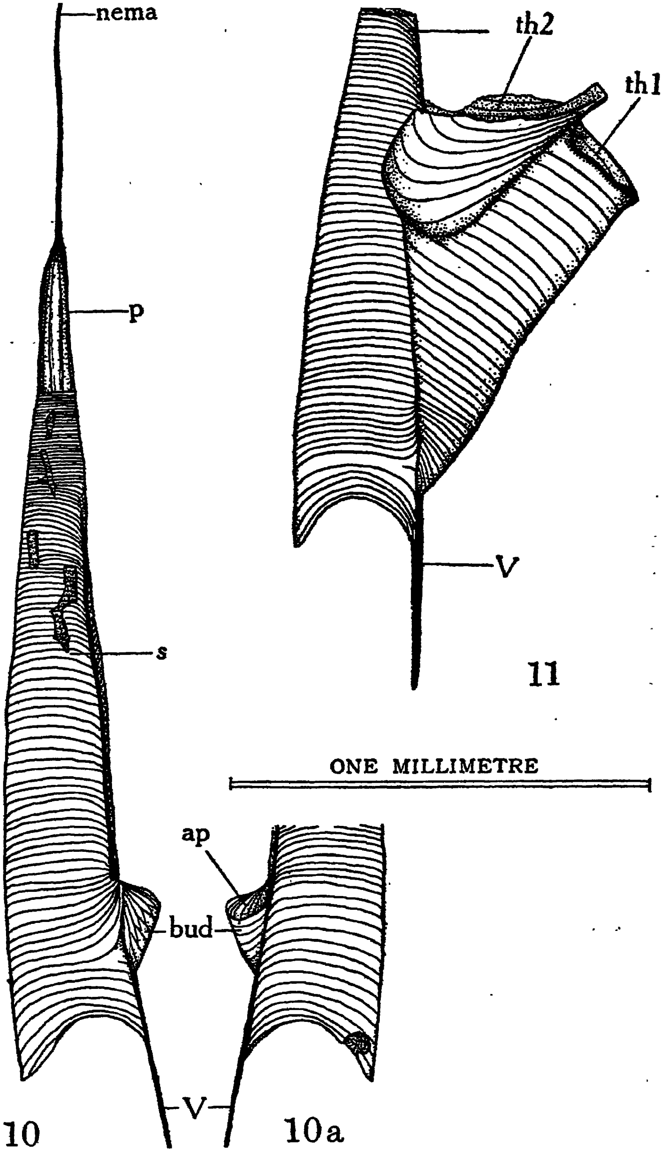
§ P. Kraft, *loc. cit.* p. 233.

Text-figs. 1–9.



Macerated specimens illustrating early stages in the ontogeny of *Monograptus dubius* (Suess).

ap, aperture of metasicula; *M*, metasicula; *n*, nema prosiculæ; *P*, prosicula; *r*, longitudinal thread; *V*, virgella. Fig. 1 is distorted. In figs. 3, 4, 5, 6, 8, & 8*a* the distal extremity is broken off. (A 5826–A 5834.)



Macerated specimens illustrating the formation of the early thecæ in *Monograptus dubius* (Suess). Fig. 10 *a* is the obverse view of the proximal portion of fig. 10.

ap, aperture of bud; *p*, prosicula; *s*, metasicula; *th* 1, first theca; *th* 2, second theca; *V*, virgella. The nema is cut off short in fig. 10, its real length being 1·30 mm. Although it is drawn in solid black, it is very apparent from microscopic examination that can be seen when macerated to continue axially into the virgella. The apex of the virgella is rounded and slightly expanded. But whereas in *Cl. inuiti* * the virgella is first formed by the third or fourth growth layer of the metasicula, and is apparent as a small narrow tongue even in the earliest stage of this part, the early bands of growth in *M. dubius* remain parallel to the aperture of the prosicula until about the 6th previous to the formation of the virgella, when they show a slight local proximal flexing which increases until one band is definitely broken by the virgella (text-figs. 8, *a*, 9). If the number of growth-bands may be taken as an indication of time, the virgella is produced later in *M. dubius* than in the Diplograptids. There is no trace of Kraft's "Stillstandsgürtel" † in these metasiculæ of *M. dubius*.

The initial bud.—The production of the initial bud is much more intimately connected with the growth of the sicula than in *Cl. inuiti*. Unfortunately no specimen arrested at the formation of the foramen was isolated; the following description is deduced from a study of lines of growth, and the specimen illustrated in text-figs. 10 & 10, *a*.

After the metasicula has been growing proximally for about 1·15 mm., its growth-bands are retarded for a short space immediately adjoining the virgella, and on its near side when seen in its reverse aspect. In this way a notch is produced, which is bordered distally by a slight hood. After about five growth-bands have been added with this distortion, the initial bud begins to lay down growth-bands both distally and proximally about the notch, the two sets wedging out one against the other. Meanwhile, normal growth has been continuing in the remaining parts of the metasicula, and the notch is constricted aperturally into a foramen, immediately before *th* 1 begins to lay down bands of growth.

The foramen is large and elongated axially. It differs in this respect from the circular foramen of the Diplograptids ‡, no doubt because the initial individual is growing sub-parallel to the sicula, and not at right angles to it, as in the former case. Furthermore, in the known cases of Diplograptids the foramen is ruptured through * the metasicula previously formed, irrespective of it, and the initial bud excretes layers of growth around it unconformable to those of the sicula. It can be seen, then, that the initial bud leaves the metasicula at an earlier stage in *M. dubius* than is the case in the Diplograptids; this is reflected in the apparent situation that while in the latter case the metasicula does not seem to contribute in any way to the formation of the skeleton of the initial bud, in *M. dubius* the formation of the "hood" marks the inception of that structure, although strictly speaking the bud in this case does not begin until the wedging out of growth-lines appears †. It may be recalled that in certain Diplograptids the first signs of the production of the second theca is a hood produced by the yet uncompleted first theca ‡.

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* Ian Cox, *op. cit.* pp. 5 & 8.

† P. Kraft, *op. cit.* p. 234.

‡ *Cf.* O. M. B. Bulman, Arkiv för Zoologi, Bd. 24 A, no. 8 & no. 9, many figures; Ian Cox, *op. cit.* fig. 6; P. Kraft, *op. cit.* Tafel xv. fig. 3.

The metasicula reaches its maximum diameter with the last growth-layer which contributes to the "hood." Below this the diameter gradually decreases in the apertural direction. About six bands are added before the metasicula is complete, and intercalation of one or two locally on the side opposite the virgella give rise to a distinct obtuse lip on the apertural margin.

III. Structure.

The first theca invests the sicula only slightly, but increasingly in the distal direction. Subsequent thecæ increase the investure, but even at the junction of the prosicula and metasicula only half the circumference is invested, and thus half the prosicula is always visible from outside the rhabdosome (text-figs. 12 & 13). At the apex of the prosicula the growth-bands of the common canal lap up against the nema by the addition of growth-bands, which taper out quickly away from the nema (text-fig. 19). The appearance at first is not unlike that of the developing metasicula about the virgella (see Pl. XI. fig. *a*). But the apparent similarity is a false

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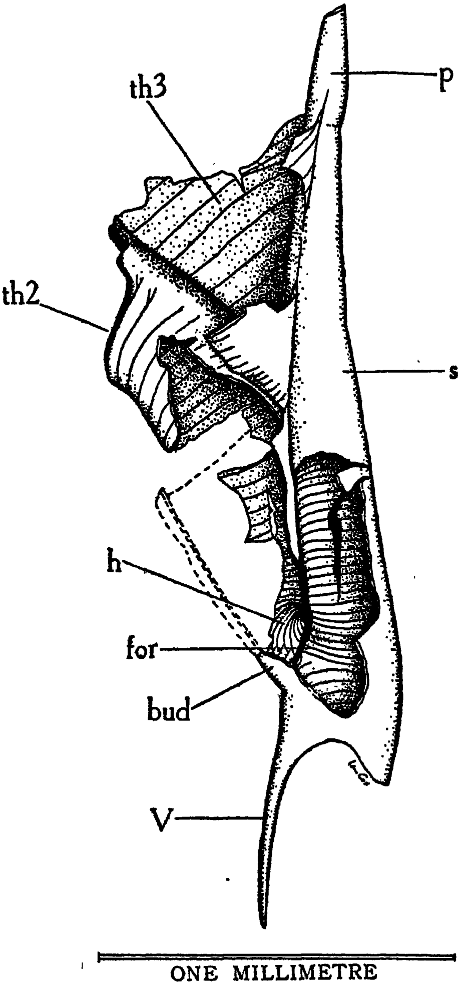
* P. Kraft, *op. cit.* p. 226; Ian Cox, *op. cit.* p. 9.

† P. Kraft, *op. cit.* p. 236, writes:—"But the eruption occurs in *Monograptus* between the bands, and they are not destroyed, but only pushed apart by the sprouting bud of the first theca" (Trans.). After a study of growth-bands in *M. dubius* the writer is unable to accept this view.

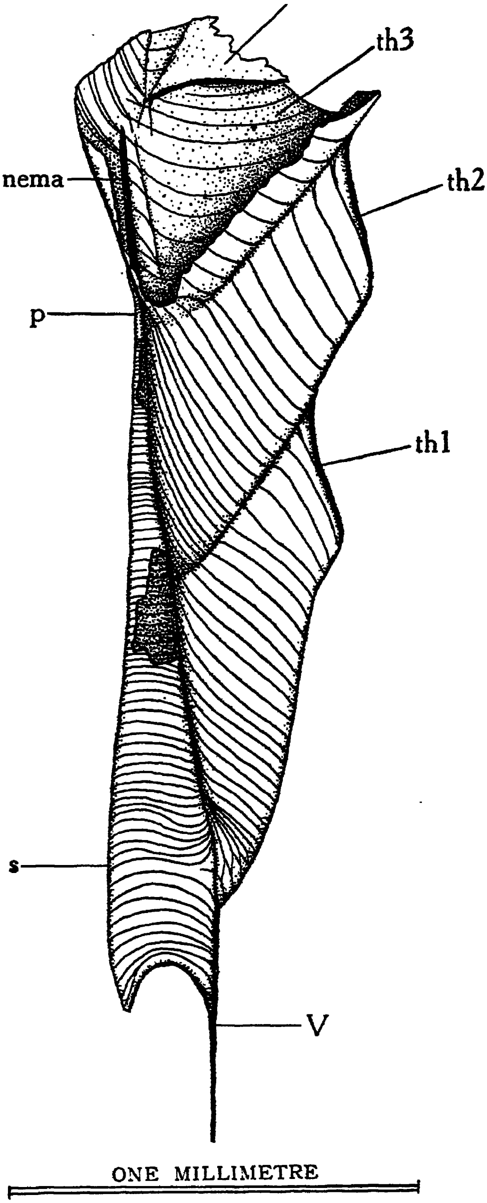
‡ O. M. B. Bulman, Arkiv för Zoologi, Bd. 24 A, no. 8, many figures; Ian Cox, *op. cit.* fig. 9.

Text-fig. 12.



Young specimen of *Monograptus dubius* (Suess), macerated and dissected from the obverse side to show the relation of the first theca to the sicula. Growth-lines are omitted from the obverse surface of the sicula.

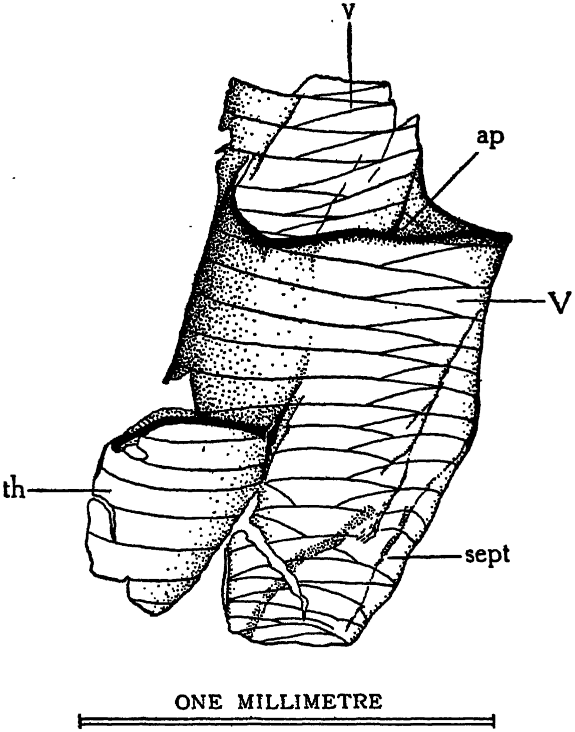
for, foramen connecting sicula with the first theca; *h*, "hood"; *p*, prosicula; *s*, metasicula; *th* 2, second theca; *th* 3, third theca; *V*, virgella. (A 5837.)



Young specimen of *Monograptus dubius* (Suess), macerated to show lines of growth. The nema is broken off short and accidentally separated from the rhabdosome wall. The reverse side of the base of theca 3 has been removed.

one, for it has been shown that the virgella is formed by an apertural production and concentration of metasicular growth-bands, while the nema is a hollow structure developed from the apex of the prosicula well in advance, and independently, of the common canal of the adult

Text-fig. 14.

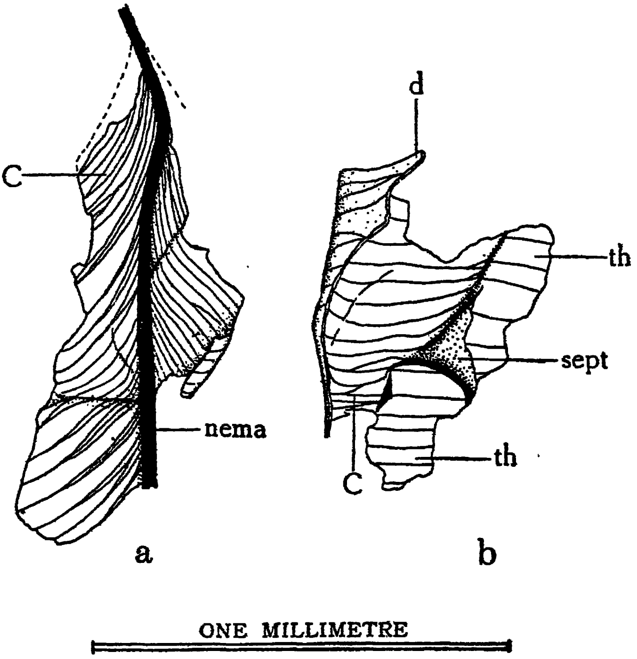


A single adult theca of *Monograptus dubius* (Suess), isolated and macerated to show the relation of the lines of growth of the interthecal septum to those of the free ventral surface of the theca.

ap, aperture of theca; *sept*, interthecal septum; *th*, inmost portion of reverse lateral wall of preceding theca bent to the left to keep the view clear. The thickened apertural margin of this theca shows as a black line and marks the level at which overlap ceases; *V*, ventral surface of complete theca; *v*, ventral surface of the succeeding theca. (A 5839.)

rhabdosome, while the distal production of the periderm of the common canal at this point is due to additional local growth-bands. In the specimen illustrated in text-fig. 10, where the initial bud is the only thecal element yet in existence, the nema (which is cut off short in the figure) is 1·30 mm. long, while the length of the sicula is 2·10 mm. It was not possible in this figure to show that the nema is hollow, although all macerated specimens (including this one) show definitely that it is so. The serial sections often show the lumen. The microscopic relation of the rhabdosome wall to the nema is not

Text-fig. 15.



Portion of *Monograptus dubius* (Suess), showing the relation of the periderm to the nema and thecæ at the distal end of the rhabdosome.

a, showing growth-lines of the common canal at the junction with the nema; *b*, showing growth-lines of the common canal at the junction with the thecae; *c*, periderm of the common canal. (A 5843.) *d*, part of this periderm where it joined the nema, turned back on the specimen; *sept*, base of interthecal septum; *th*, lateral wall of theca. (A 5850.)

easily seen. Some transverse sections show that the wall bifurcates into inner and outer layers in the immediate vicinity of the nema. These layers pass to opposite sides of the nema, leaving a small triangular interspace between the nema and the angle of their divergence. But to what extent these layers cover the nema, that is whether they meet those from the periderm of the opposite side, it is impossible to see. While Perner's four * layers of the graptolite periderm cannot be recognised in these sections, it might be mentioned that the nema of *M. dubius* never appears in transverse section as a bulge on the inner side of the periderm, as his figures show †, except in the cases of undoubtedly damaged sections. On account of the bifurcation of the periderm about it, the diameter of the nema lies on the axis of the periderm when seen in transverse section.

The free ventral wall of the thecæ shows a wedging out of growth-bands down the median line, but when these are traced down to the interthecal septum of the ventral wall, of which it is a continuation, a change in their disposition is apparent.

Text-fig. 14 shows a complete adult theca with the preceding theca removed from in front of its interthecal septum. A portion of this theca has been turned back to the left, and part of its thickened apertural margin is visible, showing the level at which the interthecal septum passes into the ventral wall of the complete theca. The bands of growth at the base of the interthecal septum do not wedge out as in the free ventral wall, but have a much more irregular arrangement, with the bands principally of lenticular shape, narrowing to each side. In this respect they resemble the growth bands of the "common canal," as is seen in text-fig. 13. This is of interest in the light of Bulman's observations. In considering *O. gracilis* he writes ‡ :—" . . . . along the centre of the rhabdosome wall there is a narrow zone, partly formed by the thinning out growth bands of the thecæ on either side, and partly

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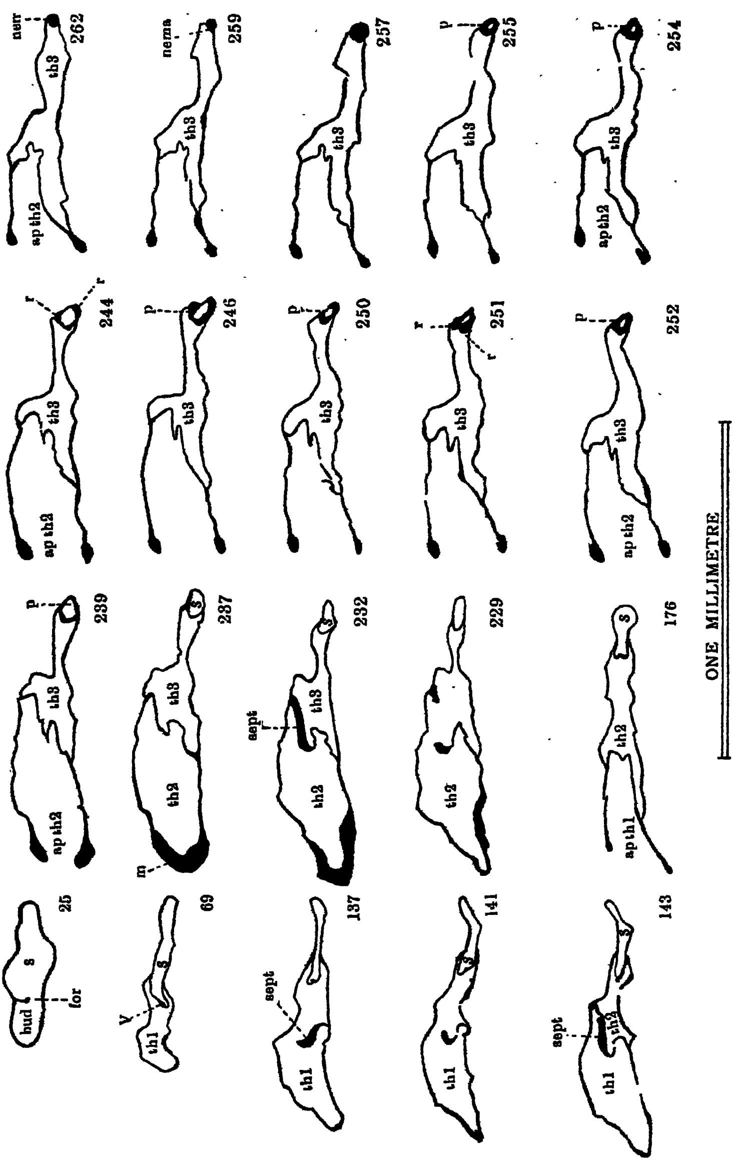
* Perner later recognised only three layers as being present. The skeleton in *M. priodon* is very thick.

† J. Perner, "Etudes sur les graptolites de Bohême," 1ère partie. Prague, 1894, p. 10 & pl. i. figs. 1 & 3, pl. ii. figs. 1 & 2.

‡ O. M. B. Bulman, "On the Graptolites prepared by Holm : Certain 'Diprionidian' Graptolites and their Development," Arkiv för Zoologi, Bd. 24 A, no. 8, 1932, p. 27 & fig. 15.



Serial sections of *Monograptus dubius* (Suess), cut on a microtome at 10 μ. The sections are numbered in order in the distal direction from the first appearance of the foramen.

ap, aperture of theca; *for*, foramen; *m*, thickened apertural margin of theca; *p*, prosicula; *r*, longitudinal threads of prosicula; *s*, metasicula; *sept*, interthecal septum. The thecæ are numbered as by convention. (A 5842.)

by lenticular growth-bands which are confined to this zone, the whole structure of which is complex and irregular. It seems reasonable to suppose that the chitinous material in this region was largely secreted independently of the thecæ on either side, and this suggests that there must have been some more or less undifferentiated tissue from which the 'zooids' were severally derived." With regard to thecæ the same author concludes *:—"Some differentiation between proximal and distal parts of a theca may be said to occur among both early (primitive) and late (specialised) graptolites, without apparently leaving any trace on the growth lines of the thecæ." The additional evidence afforded by this preparation of *M. dubius* gives support to this view of differentiation of the proximal and distal parts of the theca, but is at variance with the observation that no trace is left on the growth-lines. Thus there may be a close relation between the tissue producing the intertheca1 septum (*i. e.*, the proximal portion of the theca) and the "undifferentiated tissue from which the 'zooids' were severally derived."

The writer is indebted to Dr. O. M. B. Bulman for giving him the material from which these specimens were isolated, and for the benefit of his valuable opinion. He also thanks Professor O. T. Jones, F.R.S., and Miss G. L. Elles, D.Sc., who were kind enough to read the manuscript and offer helpful criticism.

IV. SUMMARY.

Specimens of *Monograptus dubius* (Suess) at various stages of ontogeny were isolated from a piece of limestone from Kronvall in Gottland. From examination of macerated specimens, dissections, and serial sections, comparison is made with the graptolites that have been described after similar treatment, and the following details have been established:—

I. The ontogeny of *M. dubius*.

II. The virgella is produced later than is the rule in the Diplograptids.

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* O. M. B. Bulman, "Notes on the Evolution and Morphology of certain Graptoloidea," Arkiv för Zoologi, Bd. 24 A, no. 13, 1932, p. 25.

III. The foramen of the initial bud is produced by notching and subsequent sealing up at the apertural margin of the growing metasicula, and not by rupture through pre-existing metasicular tissue as is the case in such Diplograptids as are known.

IV. The initial bud is thus produced relatively earlier than in the Diplograptids, and the metasicula contributes some part to its very early structure by the formation of a "hood."

V. The character of the growth-bands of the interthecal septum is described for the first time. These are found to resemble those of the common canal in habit and to differ from those of the distal part of the theca, thus confirming Bulman's suggestion that there must have been some undifferentiated tissue from which the "zooids" were derived and that differentiation may occur between the proximal and distal parts of the thecæ.

EXPLANATION OF PLATE XI.

Isolated specimens of *Monograptus dubius* (Suess).
***a*, A 5840 ; *b*, A 5841.**

XLIII.—*Some Icelandic Spiders*. By W. RAE SHERRIFFS, M.A., D.Sc., F.L.S., Professor of Zoology, University College, Southampton.

THE University of Cambridge Expedition to Vatnajökull was in Iceland from June 22nd to August 22nd, 1932. The account of their work has been published in 'The Geographical Journal,' vol. lxxxi. no. 4, April 1933. Mr. F. W. Anderson, M.Sc., the member of that expedition responsible for the zoological and geological reports of the area covered, is Lecturer in this department, and very kindly brought back to me all the Arachnids he found time to collect on the journey.

All the animals taken were secured by him with careful reference to the vegetation in which they were found. For convenience and under the guidance of the botanist to the Expedition, Mr. P. Falk, a number of ecological zones were determined and the fauna of each of them gathered as exhaustively as possible. In the following scheme it will be noticed that certain zones do not exist in the desert, while others, being inaccessible, could not be collected from :—

ECOLOGICAL ZONES.

A. Bare sandy desert: the dry black sand of comminuted lava forming the great bulk of the Odathahraun.
B 1. Bare rock scree with disintegrating lava completely devoid of vegetation.
  2. Isolated plants, where screes are stationary enough to allow of vegetation, usually on hill-tops.
C 1. *Salix* and dry moss.
  2. Dry pasture, *Salix* and *Festuca*.
D 1. Wet pasture, *Equisetum* and *Carex*.
  2. *Eriophorum* marsh.
  3. Marginal wet moss, *Polytrichum*, *Archangelica*.
E. Wet mud with liverworts, *Marchantia*.
F 1. Springs and small streams lined with mosses.
  2. Large streams with algæ.
  3. Shingle banks in main river.
G. Shallow temporary pools.
H. Brackish-water lagoon.

Fig. 1 is a plan of the general arrangement of the zones typical of the south-east coast of Iceland and about 100 feet above sea-level. The zones are repeated in opposite order on the farther side of the river. To understand it the spectator is supposed to be standing on the edge of the cliff at foot of the diagram and be looking down from the high ground over the landscape spread out beneath him. The highest point is thus his own position at the top of the cliff and the lowest is the main river far below. Note the emergence of the spring at the base of the scree. The locality is Selhólar.

Fig. 2 shows a section of fig. 1 along line XY. The spectator is on the top of the cliff to the left side with solid rock, scree, and river alluvium as marked.

Fig. 3 shows the relation of the zones at Hvannalindir in a typical oasis about 2000 feet above sea-level.

Fig. 1.

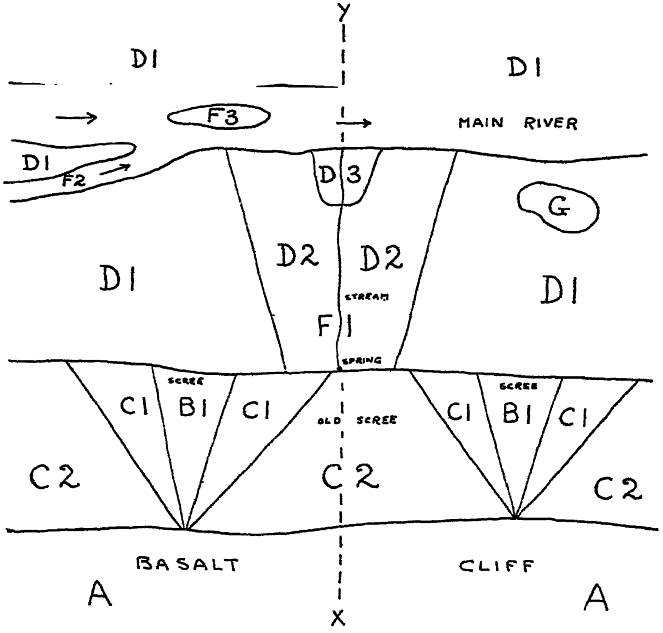


Fig. 2.

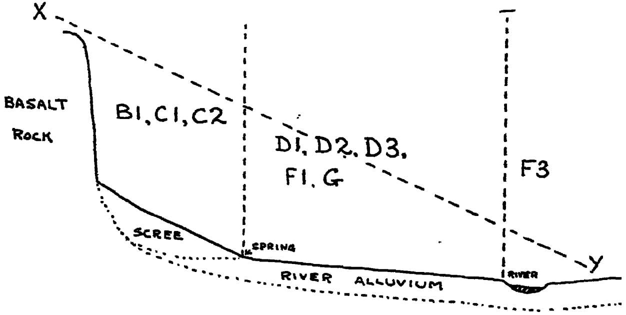


Fig. 1.—Zones at Selhólar.
Fig. 2.—Section across line XY on fig. 1.

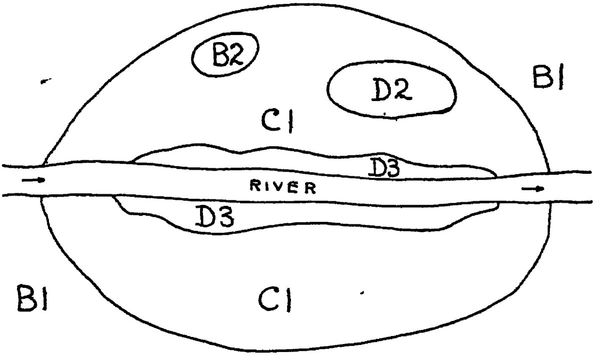
B 2 is a volcanic cone with characteristic hill-top vegetation.

The spiders collected comprised the following :—

1. *Lycosa tarsalis* Thor.
2. *Araneus diadematus* Clerck.
3. *Erigone arctica* White.
4. —— —— var. *maritima* Kulcz.
5. —— *tirolensis* L. Koch.
6. *Drassodes signifer* C. L. Koch.
7. *Hilaira frigida* Thor.
8. —— sp. (immature).
9. *Phaulothrix hardii* Bl.
10. *Robertus arundineti* Cambr.
11. *Lephthyphantes zimmermani* Bertk.
12. *Gonatium* ? (immature).
13. *Meioneta* ? (immature).

The commonest Arachnid, however, was the Harvestman, *Mitopus morio* Fabr.

Fig. 3.



Zones of typical oasis at Hvannalindir.

Not one of the above list is new to science, and not even new to Iceland. All have been previously reported by such authors and authorities as Strand, Jackson, Brendegaard, Schenkel, and Sörensen, whose works are cited below. Probably the reason why no fresh material came to hand is because of the bare and forbidding route taken by the Expedition, whose main object was to cross the ice-cap and ascertain its depth. No specimens, so far as I know, were actually captured on the ice itself, and none seem to have been taken on the peaks.

It may be useful now to consider each species mainly with regard to its ecology :—

1. *Lycosa tarsalis* Thor.

Localities :—

Place.	Zone.	No. of specimens.
Selhólar	B 2, C 1, C 2, D 2.	7 ♀, 3 ♂.
Hólar	C 2, D 1.	2 cocoons.

Note.—Usually found under stones.

2. *Araneus diadematus* Clerck.

Localities :—

Place.	Zone.	No. of specimens.
Selhólar	B 1	11 ♀ (5 immature).
Migandafoss........	B 1	—

Notes.—This spider builds a strong cable up to six feet long and formed of many threads. This stout cable is attached between rocks, and from it is suspended a large orb web twelve to fourteen inches in diameter and usually set about one foot above the level of the ground. The spider, in each case the female, was as a rule resting near the middle of the silk cable. The much smaller and rarer male was seen only once. The young female *Araneus* builds a circular web about six inches across and without any cable. She occupies the centre of the web and on your approach agitates it violently.

3. *Erigone arctica* White.

Localities :—

Place.	Zone.	No. of specimens.
Oasis (unnamed) ..	B 1, C 1, C 2	9 ♀ (1 immature).
Hvannalindir	C 1	7 ♂ (all immature).
Selhólar	F 3	—

Note.—The grass was festooned with its webs on the central moss zone of *Brachythecium rivulare* and also on the two outer zones.

Erigone arctica lives on flies belonging to the families Borboridæ, Cordyluridæ, Chironomidæ, and Simuliidæ, especially on *Simulium vittatum.*

4. *Erigone arctica* var. *maritima* Kulcz.

Place.	Zone.	No of specimens.
Hvannalindir	D 3	1 adult ♂.

Note.—Usually found under stones.

5. *Erigone tirolensis* L. Koch.

Place.	Zone.	No. of specimens.
Hveragil hot springs ..	C 1	1 ♀, 2 immature.

6. *Drassodes signifer* C. L. Koch.

Localities :—

Place.	Zone.	No. of specimens.
Selhólar	D 3	6 ♀ (1 immature).
Lake Pveit	C 1	—

Note.—Found under stones near water; cocoons with eggs taken at Lake Pveit.

7. *Hilaira frigida* Thor.

Place.	Zone.	No. of specimens.
Hveragil hot springs ..	B, C 1, D 3, E.	6 ♀ (2 immature). 3 ♂ (2 do.).

Note.—Cocoons with eggs found.

8. *Hilaira* sp. ? (specimen immature).

Place.	Zone.	No. of specimens.
Selhólar	C 1	1 ♂.

9. *Phaulothrix hardii* Bl.

Localities :—

Place.	Zone.	No. of specimens.
Selhólar	C 2	1 ♀, 1 ♂ (immature).
Höfn	C 2	—

Note.—Found on a dead tern on the beach.

10. *Robertus arundineti* Cambr.

Place.	Zone.	No. of specimens.
Lake Pveit........	C 1	1 ♀ (immature).

Note.—Under stones near water.

11. *Lephthyphantes zimmermani.*

Place.	Zone.	No. of specimens.
Hólar	C 2	2 ♀, 1 ♂.

Note.—Under stones.

12. *Gonatium* ? (immature specimen).

Place.	Zone.	No. of specimens.
Hólar	D 3	1 ♀.

13. *Meioneta* ? (immature specimen).

Place.	Zone.	No. of specimens.
Hvannalindir	D 2, D 3.	1 ♀.

Mitopus morio Fabr.

Note.—Proved the commonest Arachnid in the collection.

Localities :—

Place.	Zone.	No. of specimens.
Odathahraun	A	14 ♂ & 14 ♀.
Oasis (unnamed)	A, B 1, B 2, C 1, C 2, C 3	—
Hvannalindir	A, B 1, C 1.	—
Selhólar	B 1, C 2, D 1, D 2, D 3.	—

Note.—Occasionally this Harvestman was noticed wandering in the desert miles distant from vegetation.

My best thanks are due to Mr. Anderson for collecting the material, and also for supplying the data required for this paper, to Messrs. Strand, Brendegaard, and Schenkel for recent literature on Icelandic spiders, and especially to Dr. A. Rendle Jackson for most kindly, out of his great experience of Palæarctic Arachnids, examining all the specimens, confirming names assigned by me, and naming all specimens new to me.

SUMMARY.

1. *Lycosa tarsalis*, commonest on dry pastures with *Salix* and *Festuca*.
2. *Araneus diadematus*, only on bare rock screes devoid of vegetation.
3. *Erigone arctica*, commonest on *Salix* and dry moss below stones.
4. *Erigone arctica* var. *maritima*, only on marginal wet moss with *Polytrichum* and *Archangelica*.
5. *Erigone tirolensis*, on *Salix* and dry moss only.
6. *Drassodes signifer*, commonest on *Salix* and dry moss, but always near water, also from marginal wet moss.
7. *Hilaira frigida*, from hot springs.
8. *Phaulothrix hardii*, in dry pasture with *Salix* and *Festuca*.
9. *Robertus arundineti* on *Salix* and dry moss.
10. *Lephthyphantes zimmermani* on dry pasture with *Salix* and *Festuca*.
11. *Mitopus morio* was found freely on dry land, but was most abundant in the hot spring areas. It was noted, however, on the *Eriophorum* swamp which had a pH of 6·5.

The total number of Arachnids collected amounted to sixty-five spiders, twenty-eight harvestmen, and seven mites yet to be determined—one hundred in all.

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XLIV.—*Otoliths of Fishes from the Lower Tertiary Formations of Southern England.—IV. Scleroparei, Percomorphi.* By G. ALLAN FROST, F.L.S., F.G.S.

[Plate XII.]

Order SCLEROPAREI (*cont.*).

Otolithus (*Trigla*) *rhombicus* Schubert.
(Pl. XII. fig. 1.)

R. Schubert, "Die Fischotolithen des öster-ung. Tertiärs.—III.," Jahrb. der k.k. geol. Reichanst. Bd. lvi. p. 641, pl. xx. figs. 6, 7 (Wien, 1906).

Resembles in the sulcus that of the Recent species *Trigla hirundo* *, but differs in the rounded dorsal rim and in the depth of the ventral rim. Described by

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* G. Allan Frost, "A Comparative Study of the Otoliths of the Neopterygian Fishes," Ann. & Mag. Nat. Hist. ser. 10, vol. iv. p. 250, pl. iii. fig. 7 (1929).

Schubert from the Miocene of Voslau and by Priem * from the Burdigalian of Léognan, S.W. France.

Two specimens, 5×5 mm. Upper Eocene, Barton, Hampshire.

Otolithus (*Trigla*) *mirabilis* Bassoli †.
(Pl. XII. fig. 2.)

Resembles in shape that of the Recent species *Trigla lyra* (Frost, *t. c.* p. 259, pl. iii. fig. 10), but differs in the absence of an upper angle in the sulcus, and in the opening of the cauda on the posterior rim. Described by Bassoli from the Middle Miocene of Monte Gibio, Italy.

One specimen, 6×5 mm. Upper Eocene, Barton, Hampshire.

Otolithus (*Trigla*) *ovatus*, sp. n.
(Pl. XII. fig. 3.)

Shape ovate, outer side concave, inner side convex; dorsal rim curved, passing into the rounded posterior rim; ventral rim curved, serrated, with furrows extending to a slight ridge above it; anterior rim with small rostrum, antirostrum, and excisura. Sulcus horizontal, constricted medianly, without angles; ostium rather narrow, cauda distended, downturned.

Resembles that of the Recent species *Trigla lyra*, but differs in the absence of an upper angle in the sulcus, in the downturned cauda, and in the curved ventral rim.

One specimen, 4×2½ mm. Upper Eocene, Barton, Hampshire.

Order PERCOMORPHI (*cont.*).

Suborder Blennioidea.

Otolithus (*Ophidiidarum*) *waltoni* Schubert.
(Pl. XII. figs. 4–5.)

R. Schubert, "Obereocäne Otolithen vom Barton Cliff bei Christchurch," Jahrb. der k.k. Geol. Reichsanst. Bd. lxv. p. 284, Taf. vii. figs. 30–32 (Wien, 1915).

Sulcus resembles that of the Recent species *Neobythites steaticus* (Frost, *t. c.* p. 124, pl. i. fig. 20).

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* F. Priem, "Sur des Otolithes de Poissons fossiles des terrains supérieurs du Sud-Ouest de la France," Bull. Soc. géol. de France, sér. 4, vol. vi. p. 265 (Paris, 1906).

† G. G. Bassoli, "Otoliti fossili terziari dell' Emilia," Rivista Italiana Paleontologia, Anno xii. fasc. i. p. 53, Tav. ii. figs. 40–41 (Perugia, 1906).

Numerous specimens up to 6 × 4 mm. Upper Eocene, Barton, Hampshire.

Otolithus (*Ophidiidarum*) *planus*, sp. n.
(Pl. XII. fig. 6.)

Shape long, wedge-like, outer side convex, inner side flat, curved longitudinally ; dorsal rim highest anteriorly ; ventral rim gently curved ; posterior rim pointed ; anterior rim oblique, with a wide margin present between it and the sulcus ; there is no crest behind the cauda as in *O.* (*Ophid.*) *waltoni*. Sulcus enclosed, straight, tapering ; ostium ovate ; cauda small and in line with the ostium.

Numerous specimens up to 4 × 2 mm. Upper Eocene, Barton, Hampshire.

Otolithus (*Ophidiidarum*) *sagittalis*, sp. n.
(Pl. XII. fig. 7.)

Shape lanceolate, flat ; dorsal rim curved, indented on posterior part ; ventral rim curved ; posterior rim with indentation ; anterior rim pointed. Sulcus enclosed, a lower angle present, upper margin straight ; ostium distended ventrally ; cauda small, in line with ostium.

One specimen, 5 × 2½ mm. Lower Eocene, London Clay, Worcester Park, Surrey.

Otolithus (*Ophidiidarum*) *symmetricus*, sp. n.
(Pl. XII. fig. 8.)

Shape lanceolate, biconvex ; dorsal rim straight, forming angles with the anterior and posterior rims ; ventral rim curved, regular ; posterior rim rounded ; anterior rim pointed, upper part oblique. Sulcus straight, resembling that of *O.* (*Ophid.*) *sagittalis*.

One specimen, 5½ × 2½ mm. Lower Eocene, London Clay, Isle of Sheppey.

Otolithus (*Ophidiidarum*) *sheppeyensis*, sp. n.
(Pl. XII. figs. 9–11.)

Shape ovate, biconvex, outer side smooth ; dorsal rim low ; ventral rim curved ; posterior rim oblique, forming point with ventral rim ; anterior rim oblique. Sulcus enclosed, with lower angle ; ostium ovate ; cauda small and downcurved.

Resembles in outline *O.* (*Ophid.*) *difformis* var. *joachimica* Koken * from the Middle Oligocene of Joachimsthal, but differs in the smooth outer side and in the narrower sulcus.

Five specimens up to 5 × 3 mm. Lower Eocene, London Clay, Isle of Sheppey, and Worcester Park, Surrey.

Otolithus (*Ophidium*) *biscaicum* Sulc.
(Pl. XII, figs. 12–14.)

Described by Sulc from the Bartonian of Biarritz †. It resembles in shape the otoliths of the Recent species *Ophidium barbatum* (Frost, *t. c.* p. 125, pl. i. fig. 22), but differs in the sulcus, which resembles that of *Neobythites* (*t. c.* fig. 20).

Eight specimens from Barton, two from Sheppey, av. 4 × 3 mm. Upper Eocene, Barton, Hampshire, and Lower Eocene, London Clay, Warden Point, Sheppey.

Otolithus (*Ophidium*) *biarritzense* Sulc.
(Pl. XII. fig. 15.)

Jaroslav Sulc, *t. c.* p. 82, pl. ii. fig. 13 *a.*

Described by Sulc from the Bartonian of Biarritz, this species differs from the preceding forms in the undivided sulcus and in the small prominence on the anterior rim, above which a small groove descends to the sulcus.

One specimen, 5 × 4 mm. Lower Eocene, London Clay, Worcester Park, Surrey.

Otolithus (*Ophidiidarum*) *rugosus*, sp. n.
(Pl. XII. fig. 16.)

Shape ovate; outer side convex, smooth; inner side flat, depressed, with a narrow groove above the sulcus. Dorsal rim irregular; ventral rim deepest anteriorly; posterior rim small, rounded; anterior rim oblique. Sulcus enclosed, horizontal, divided.

One specimen, 4½ × 3½ mm. Lower Eocene, London Clay, Worcester Park, Surrey.

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* E. Koken, "Neue Untersuchungen an tertiären Fisch-Otolithen.—II.," Zeitschr. der deut. geol. Gesellschaft, Bd. xliii. p. 77, pl. i. fig. 7 *a* (Berlin, 1891).

† Jaroslav Sulc, "Les Otolithes du Paléogène des Environs de Biarritz," Rospravy Státniho geol. úst. Ceskoslovenské Republicky, vol. vii. p. 81, pl. ii. fig. 11 *a* (Prague, 1932).

Otolithus (*Ophidiidarum*) *elegans*, sp. n.
(Pl. XII. fig. 19.)

Shape ovate, outer side furrowed, inner side flat; dorsal and ventral rims curved and dentated; posterior rim pointed; anterior rim rounded. Sulcus enclosed, divided by slight lower angle.

Resembles *O.* (*Ophid.*) *occultus* Koken, from the Middle Oligocene of Offenbach, A.M. (*t. c.* pl. vi. figs. 1–1 *a*), but differs in the regularity of the outline and in the upturned anterior part of the sulcus.

One specimen, 2 × 1½ mm. Upper Eocene, Barton, Hampshire.

Otolithus (*Ophidiidarum*) *hilgendorfii* Koken.
(Pl. XII. figs. 17–18.)

E. Koken, 1891, *t. c.* p. 77, Taf. v. fig. 14.

In the example figured as no. 17 the shape is ovate, thick, and biconvex; the outer side is umbonated, and the sculpturing of the inner side prominent; the length is exactly twice the height. In another specimen (no. 18) the shape is longer and the posterior part tapered; the inner side is flat, and the length is more than twice the height.

In both the sulcus is undivided and enclosed, with a depression above it.

Described by Koken from the Lower Oligocene of Lattorf, Germany.

Six specimens, 3 × 1½ to 8 × 3½ mm. Upper Eocene, Barton, Hampshire.

EXPLANATION OF PLATE XII.

Fig. 1. *Otolithus* (*Trigla*) *rhombicus* Schubert.
Fig. 2. —— (——) *mirabilis* Bassoli.
Fig. 3. —— (——) *ovatus*, sp. n.
Figs. 4, 5. —— (*Ophidiidarum*) *waltoni* Schubert.
Fig. 6. —— (——) *planus*, sp. n.
Fig. 7. —— (——) *sagittalis*, sp. n.
Fig. 8. —— (——) *symmetricus*, sp. n.
Figs. 9, 10, 11. —— (——) *sheppeyensis*, sp. n.
Figs. 12, 13, 14. —— (*Ophidium*) *biscaicum* Sulc.
Fig. 15. —— (——) *biarritzense* Sulc.
Fig. 16. —— (*Ophidiidarum*) *rugosus*, sp. n.
Figs. 17, 18. —— (——) *hilgendorfii* Kok.
Fig. 19. —— (——) *elegans*, sp. n.

XLV.—*The Elk of Siberia.* By EDGAR N. BARCLAY. (From the Department of Zoology, British Museum (Nat. Hist.).)

SINCE Lydekker gave the specific name of *bedfordiæ* to the elk of Siberia (Proc. Zool. Soc. 1902, vol. i. p. 109) much has been written concerning the validity of this species, Rothschild (*ibid.* vol. ii. p. 317) strongly supporting Lydekker's view and Lönnberg and Elwes (*ibid.* p. 353 and 1903, vol. i. p. 147) being equally emphatic in rejecting it. The species was differentiated on the character of the antlers, which are usually of the forked, non-palmate type, but all these authors either overlook or fail to stress the very essential point that palmation of antlers is not a constant character in any living deer. If we fail to recognise this fact we could with equal justice specifically separate the fallow deer of the New Forest from the typical form of *Dama* merely because the majority of the bucks from that locality develop non-palmated antlers. There are in the British Museum more than forty pairs of antlers from the New Forest, and the majority are without a trace of palmation. In all the Cervidæ actual antler structure does afford a character of systematic value, but palmation is a variable modification which tends to obliterate, but never to alter, the actual pattern. Pocock has aptly described palmation in the antlers of *Alces* as "the development of bony tissue between the tines" (Proc. Zool. Soc. part 2, 1933, p. 394). All antler growth is primarily dependent on the quality of the sub-soil and the suitability of the browsing and grazing. Heredity is also a factor, but this is never strong enough to counteract the effects of poor feeding. In the case of the elk abundant production of antler tissue manifests itself in palmation and this not only varies from the cause already named, but also with age. The Siberian elk material in this country is extremely scanty, of the five pairs of antlers that I have examined three are in Lord Rothschild's Museum at Tring and two are in the British Museum. All of these specimens are poorly developed, and, as might be expected, show no palmation. A much finer example in the Hagenbeck collection at Hamburg displays a moderate degree of palmation, whilst Elwes states that the only horns of the elk which he "succeeded in obtaining in the Altai Mountains in 1898, which are now in the St. Petersburg Museum, were palmated in precisely the same manner as those of the Norwegian elk," and others which he saw in Russian collections had well-developed palmation (Proc. Zool. Soc. 1903, vol. i. p. 148).

Non-palmated antlers of the elk from other localities appear to be indistinguishable from Siberian examples, and the following specimens of this type in the British Museum have been examined—two from Sweden, one from Norway, two from Russia, one from Ontario, Canada, and a single antler labelled North America. The elk (moose) attains its highest development in North America, but the assumption not uncommonly expressed, that its antlers are always palmated, is incorrect.

Lydekker's diagnosis of *bedfordiæ* was based entirely on the antlers, and on these grounds I do not accept the species as valid. In his later writings he relegated it to subspecific rank, but until material is available to compare skins and to gain an understanding of age and seasonal changes of coat it can hardly be regarded as entitled to distinction.

XLVI.—*Critical Notes on some Neotropical Species of* Tomaspis (*Homoptera,* Cercopidæ). By W. E. CHINA and J. G. MYERS, M.A., Sc.D.

IN the course of investigations by Dr. J. G. Myers and Mr. A. Pickles on the sugar-cane froghopper (*Tomaspis saccharina* Distant) other species have been studied in Trinidad and on the mainland both for ecological reasons and in the search for parasites, and it was desirable that all these forms should be authoritatively determined. The species here considered, having been selected for economic or comparative interest, represent but a small proportion of the large and unwieldy genus *Tomaspis*, and neither do they comprise all the forms occurring in the region (mainly north-eastern South America) traversed. Schmidt (1920, p. 65) * has already pointed out the desirability of dividing up the old genus *Tomaspis*, but the segregates long ago proposed by Amyot and Serville did not prove very workable. Schmidt recognizes six genera, grouped in a tribe Ischnorhinini, containing species obviously only distantly related to the material studied in this paper. In the present study very definite groups among the more typical members of the genus have been found to be correlated with form, male genitalic structure, and ecological characters. Without examining all the available species of *Tomaspis* it is impossible to ascertain the limits of these groups, and they have accordingly been given no nomenclatorial standing, but are merely indicated by the name of a typical species (*e. g.*, the *saccharina* group).

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* "Tribus Ischnorhinini, Beitrag zur Kenntnis der Cercopiden (Rhynchota Homoptera)," Stettin. Ent. Zeit. lxxxi. pp. 65–96.

The material considered in this paper was collected almost solely in Trinidad, Tobago, Venezuela, the Guianas, and the Lower Amazon. Species from outside these limits were only included when they were obviously closely related. Within these limits the species listed probably comprise a sufficient proportion of their respective groups to enable forms discovered later to be placed easily according to their relationships.

The groups can be summarized as follows :—

I. *SACCHARINA* GROUP.

To this belong the following species :—

Tomaspis saccharina Distant. St. Vincent, Grenada, Trinidad.
T. carmodyi Kershaw. Tobago.
T. bodkini Williams. British Guiana, Venezuela.
T. propinqua Walker. Venezuela.
T. demissa Walker. Venezuela.
T. postica Walker. Mexico.
T. flavilatera Urich. British Guiana (coast).

Probably *T. varia* Fabr. (Cayenne) is a member of this group, but we have no material.

Except for *T. flavilatera*, which is exceedingly close structurally to *saccharina*, but aberrant in coloration, the colour and pattern in this group are remarkably constant, consisting essentially of a dark, brownish or black ground, with two red, orange, or yellow bands or series of spots across the folded tegmina. The size is small and shows little specific or individual variation.

Ecologically, so far as we know, all are grass-feeding species, and the nymphs of all place their spittle-masses low down on the host, sometimes actually below the surface of the ground. Whether the habit of *saccharina* of laying a large proportion of its eggs actually in the soil is general or not we do not yet know.

The male genitalia show great constancy in the ædeagus, but there are excellent specific characters in the genital plates and the parameres. Two sub-groups may be distinguished on the shape of the genital plates, while *postica* shows the most distinct parameres. The genital plates of *saccharina*, *propinqua*, and *demissa* have an apical tooth, while those of *bodkini*, *carmodyi*, and *postica* are apically truncate.

II. *TERREA* GROUP.

Tomaspis terrea Germar. Lower Amazon, Argentina.
T. morialis, sp. n. Lower Amazon.
T. rhynchosporæ, sp. n. Venezuela, British Guiana, Lower Amazon.
T. incompleta Walker. Lower Amazon.
T. picklesi, sp. n. Lower Amazon.

The colour and pattern are fairly constant, but there is a much greater variation in size than in the *saccharina* group. The prevailing colour is a fawn, sometimes, as in *terrea*, unrelieved by spots or bands, but darkened on the extremities and the head. More often there are pale markings, of which the most constant are a costal band and a claval stripe, these forms considerably resembling *T. flavilatera*.

All are grass-feeding species save *T. rhynchosporæ*, which is closely attached to savannah sedges of the genus *Rhynchospora*. All save *T. morialis*, which in this respect resembles *tristis*, are terrestrial forms, placing their spittle-masses on the surface of the ground at the base of the plants. All except *T. incompleta*, which is an original forest species like *T. saccharina*, are savannah forms.

Within this group the male genitalic structure suggests a division into two sub-groups, one, containing *terrea*, *morialis*, and *rhynchosporæ*, in which the *œdeagus* is similar, the main differences lying, as in the *saccharina* group, in the parameres and genital plates; and the other, consisting of *incompleta* and *picklesi*, agreeing in the corrugated genital plates, but differing strikingly in the *œdeagus*.

III. *Tristis* Group.

Tomaspis tristis Fabr. Trinidad, Guiana, Lower Amazon.
T. mura, sp. n. Lower Amazon.
(*T. intecta* Walk. MS. is syn.)

These are large and (save some males) dark, obscure-coloured species, usually some shade of brown with two broken lines of yellowish or red spots. There is a greater difference between the sexes than in the two previous groups.

They differ from all the species previously considered save *T. morialis* in frequenting the upper part of the grass-host, usually placing their spittle-masses in close proximity to the growing point.

In male genitalic structure the main differences lie in the parameres. The ædeagus strongly resembles that of the *saccharina* group, but its paired appendages are broader.

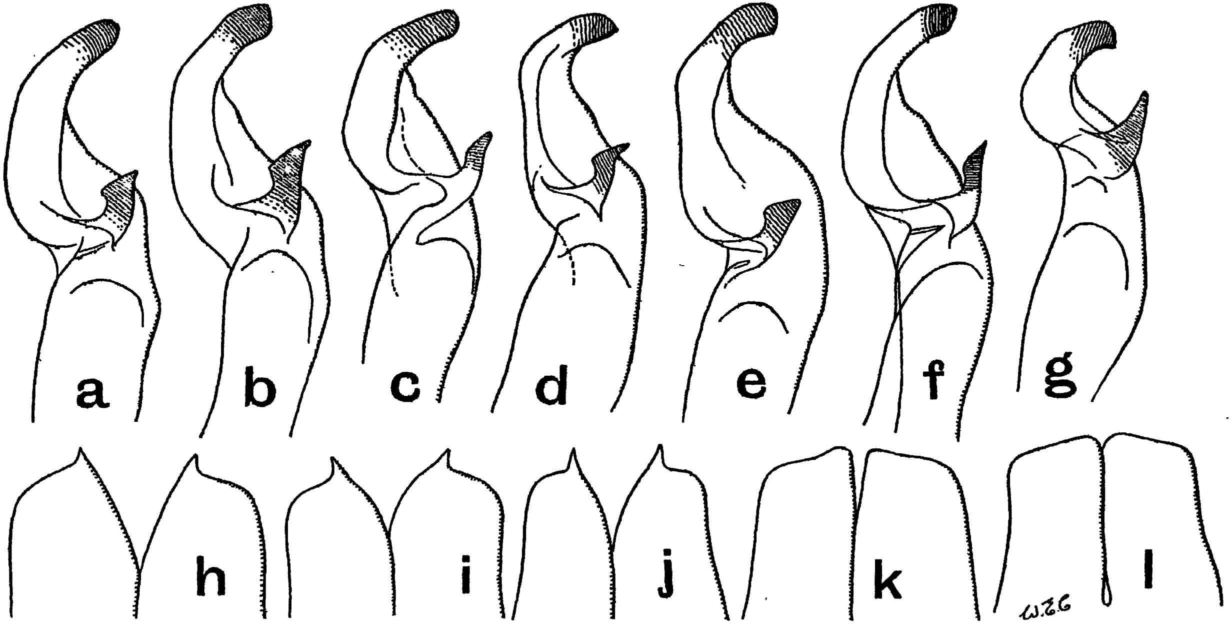
In this group the frons is markedly angularly prominent, not only much more so than in the *terrea* group, but distinctly more angulate than in the *saccharina* group.

Isolated Species.

T. rubra Linn., *T. pubescens* Fabr., and *T. lineola* Fabr. are all very distinct in male genitalic structure from any of the above groups, and also *inter se*. *T. radicis* is apparently closely related to *T. undulata* Lall., from Ecuador, the type of which (and only available material) has, unfortunately, the abdomen missing. It is widely distinct from any of the other species seen. Of course, all these four species may eventually prove typical of wider groups when material from other areas is examined.

The rest of the paper deals with the synonymy and male genitalic structure of the species considered, with the description of new forms. A synonymic list, with references to the original descriptions, is appended.

Fig. 1.



Dorsal view of left-hand male paramere:—*a*. *Tomaspis demissa* Walk.; *b*. *T*. *saccharina* Dist.; *c*. *T*. *carmodyi* Kersh.; *d*. *T*. *bodkini* Williams; *e*. *T*. *propinqua* Walk.; *f*. *T*. *flavilatera* Urich; *g*. *T*. *postica* Walk. Apices of male subgenital plates:—*h*. *T*. *demissa* Walk; *i*. *T*. *saccharina* Dist.; *j*. *T*. *propinqua* Walk.; *k*. *T*. *bodkini* Williams; *l*. *T*. *postica* Walk. (Parameres at a greater magnification than subgenital plates, but each series of uniform magnification.)

The *Saccharina* Group.

Tomaspis saccharina Dist. (Fig. 1, *b* & *i*; fig. 2, *c*.)

The St. Vincent record for this species, known otherwise only from Trinidad and Grenada, is based on only two specimens in the British Museum; but the record must nevertheless be considered authentic, the material having been taken by the well-known collector H. H. Smith. This distribution is closely paralleled by that of certain *Diatræa* species in the Lepidoptera. The dissection of the male genitalia was made on the holotype (Trinidad, no specified locality).

Tomaspis carmodyi Kershaw. (Fig. 1, *c*; fig. 2, *e* & *h*.)

This species is recorded only from Tobago. We have, however, examined several females from the northern part of Trinidad which seem identical with *carmodyi*, but no males have yet been available to authenticate the record. The dissection of the male genitalia was made on the holotype (Tobago, Old Grange).

Tomaspis bodkini Williams.
(Fig. 1, *d* & *k*; fig. 2, *a*.)

Of all the mainland species this is superficially the nearest to *saccharina*. In the male genitalia, however, it shows closer relationship to *carmodyi*. It has been taken in the North-west District, British Guiana, the Orinoco Delta, Ciudad Bolivar, and the Pakaraima Mountains. The dissection of the male genitalia was made on a topotype from the original series on which the first description was drawn up by Pickles (1932), the species having been published by Williams (1921) as a coloured figure without description.

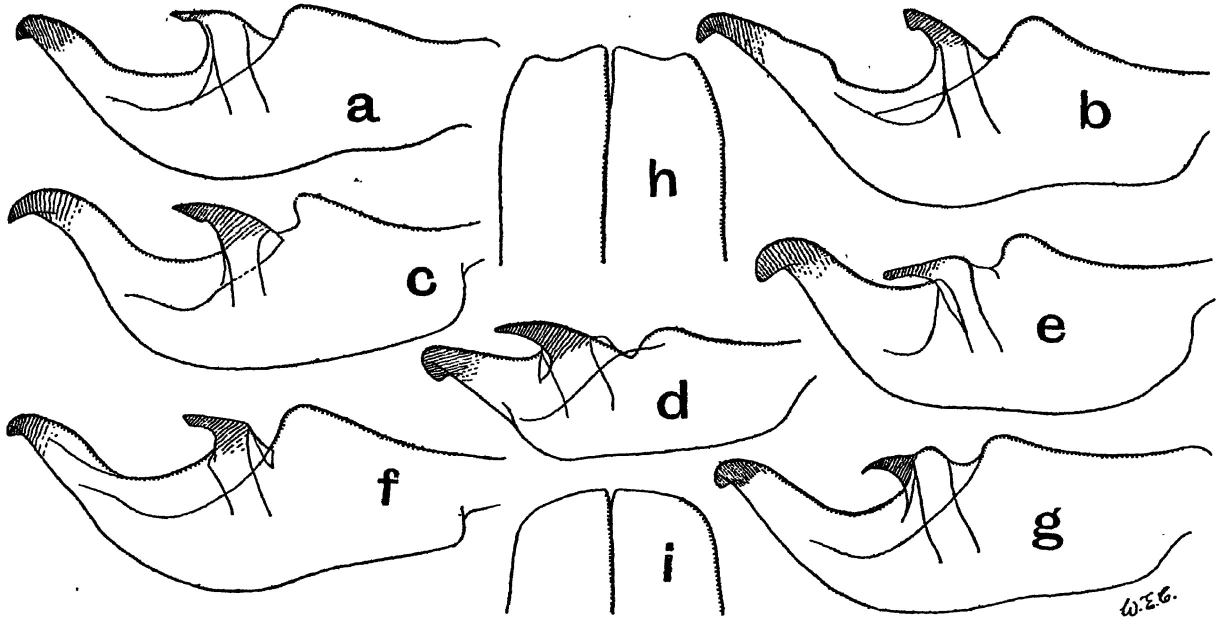
Tomaspis propinqua Walker.
(Fig. 1, *e* & *j*; fig. 2, *b*.)

The dissection of the male genitalia was made on the holotype from Venezuela without precise locality. Exactly similar material has been taken in the Valley of Caracas. Williams collected it at La Guaira.

Tomaspis demissa Walker.
(Fig. 1, *a* & *h*; fig. 2, *f*.)

The dissection of the male genitalia was made on the holotype from Venezuela without precise locality. This

Fig. 2.



Interior lateral view of left-hand male paramere :—*a. Tomaspis bodkini* Williams ; *b. T. propinqua* Walk. ; *c. T. saccharina* Dist. ; *d. T. postica* Walk. ; *e. T. carmodyi* Kersh. ; *f. T. demissa* Walk. ; *g. T. flavilatera* Urich. Apices of male subgenital plates :—*h. T. carmodyi* Kersh. ; *i. T. flavilatera* Urich.

remains the only material seen. It resembles *carmodyi* in form and pattern, with the posterior fascia reduced to a costal spot. It is considerably paler than the average of *carmodyi*. The genitalia show it to be very closely related to *saccharina*. *T. semifascia* Walker (1851, p. 679) is, contrary to Lallemand's opinion, distinct from *T. demissa* (1851, p. 684), but is represented only by two females. The fasciæ are more nearly complete and bright red instead of dull yellow. The type is from Venezuela and an exactly similar female from Colombia, so the range is probably more western than that of *demissa*. *T. semifascia* Walker, of 1859, is, as shown below, an entirely different species, but as it falls in the synonymy of *tristis* Fabr. there is no need for a new name. It was erroneously synonymized by Lallemand (1912, p. 97) with *T. rubra* Linn., which it does not resemble.

Tomaspis postica Walker.

(Fig. 1, *g* & *l*; fig. 2, *d*.)

The male genitalia are figured from an allotype from Atoyac, Vera Cruz, Mexico, selected in comparison with the holotype, which is a female from an unknown locality in Mexico. This species is practically identical in size, colour, and pattern with *bodkini*, not smaller as Williams' plate would indicate. In spite of this extraordinary resemblance, the paramere of *postica* is structurally the most isolated in the group.

Tomaspis flavilatera Urich.

(Fig. 1, *f*; fig. 2, *g* & *i*; fig. 7, *b*.)

The male genitalia are figured from the holotype (Experiment Fields, Botanical Gardens, Georgetown, Demerara). In colour and pattern this species would appear to belong to the *terrea* group, but the male genitalia are very similar to those of *saccharina*.

The *Terrea* Group.

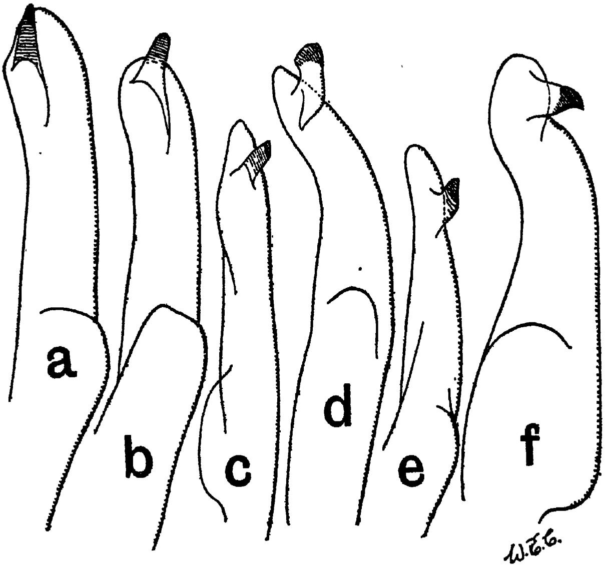
Tomaspis terrea Germar.

(Fig, 3, *a*; fig. 4, *d*; fig. 5, *a*; fig. 7, *c*.)

The type-locality is "Brasilia." There is a long series in the British Museum from the Argentine, but the

Brazilian material from Marajo Island (J. G. Myers) agrees more closely with the original description, and a plesiotype has been selected from it for the figure of the male genitalia. The genitalia of the Argentine specimens are closely similar.

Fig. 3.



Dorsal view of left-hand male paramere :—*a. Tomaspis terrea* Germ.; *b. T. morialis*, sp. n.; *c. T. rhynochosporæ*, sp. n.; *d. T. incompleta* Walk.; *e. T. picklesi*, sp. n.; *f. T. radicis*, sp. n.

Tomaspis morialis, sp. n.

(Fig. 3, *b*; fig. 4, *e*; fig. 5, *e*; fig. 7, *d*.)

Dull dark brown, with the frons, clypeus, anterior two-thirds of pronotum, basal half of scutellum, basal third of costal margin, outer half of clavus, small triangular spot at base of corium between claval and costal stripes, and two round spots on a level with apex of clavus (one on the costal margin and the other on the inner margin of the corium) dull yellow. Pronotal scars and lateral margins of pronotum dark brown. Legs pale brown, with the trochanters, apices of femora, extreme base of tibiæ, and the whole of the hind tibiæ pale sordid yellow ; tarsi dark brown.

The pronotum and tegmina are covered with dense pale yellow pubescence, which is distinctly longer than in *terrea*.

Frons feebly globose, much less produced than in *terrea*.

Male genitalia as figured.

The female resembles the male, but the whole pronotum is sometimes yellow save a narrow lateral margin. There is also a pallid spot around the ocelli.

Length, male 10·2 mm., female 10·6 mm.

Holotype and *allotopotype*, Parana do Ramos, Lower Amazon (*J. G. Myers*).

Described from four females and three males from Lower Amazon (between Santarem and Parana da Eva) and Madeira River.

The specific name is taken from the favourite host-plant, the grass, Mory (*Paspalum fasciculatum*).

Tomaspis rhynchosporæ, sp. n.

(Fig. 3, *c* ; fig. 4, *c* ; fig. 5 *b* ; fig. 7, *e*.)

Bright fulvous, the tegmina distinctly paler, especially towards the costal margin, with the clavus slightly infuscate. Abdomen beneath with the disc dark brown. Tarsi and spines of tibiæ black.

Tegmina very finely and densely punctate. Pubescence similar to that of *terrea* but less dense.

Frons feebly globose, much less produced than in *terrea*.

Male genitalia as figured.

The female resembles the male in colour and form, but indications of a costal stripe more distinct.

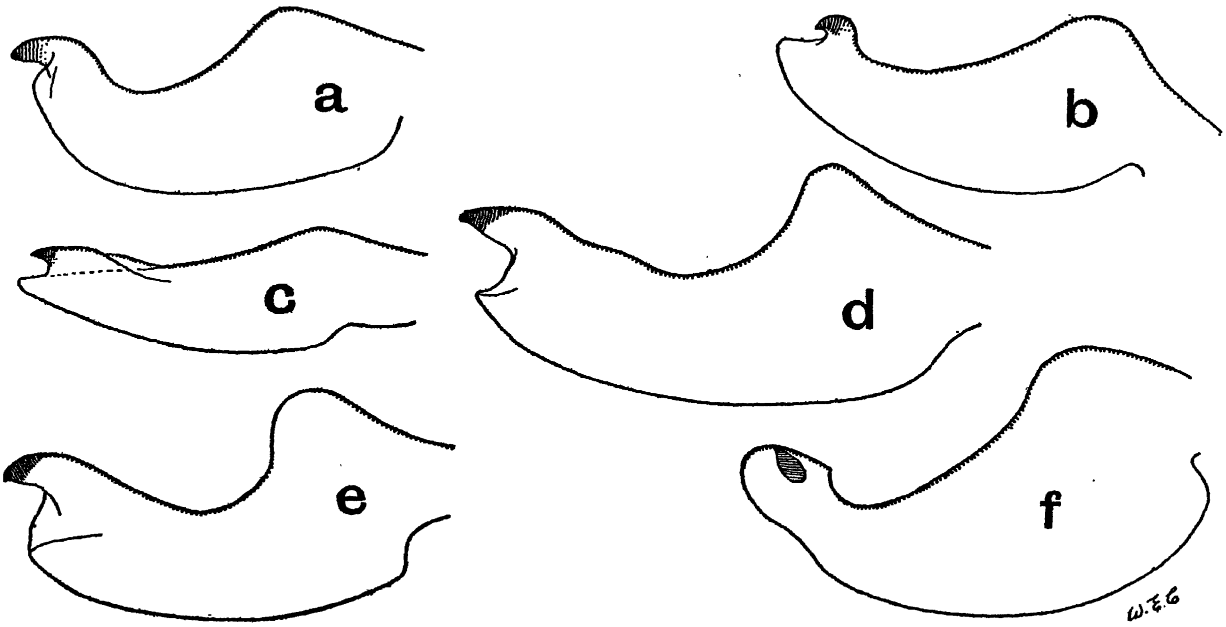
Readily distinguished from all other *Tomaspis* known to us by its small size.

Length, male 5·2 mm., female 6·0 mm.

Holotype and *allotopotype*, Mt. Roraima, Venezuela (*J. G. Myers*).

Described from one male and five females, all topotypical. This species occurs also at Para and on the Rupununi savannahs of British Guiana. It is purely a savannah species attached closely to sedges of the genus *Rhynchospora*, whence the specific name.

Fig. 4.



Interior lateral view of left-hand male paramere:—*a. Tomaspis incompleta* Walk.; *b. T. picklesi*, sp. n.; *c. T. rhynchosporæ*, sp. n.; *d. T. terrea* Germ.; *e. T. morialis*, sp. n.; *f. T. radicis*, sp. n.

Tomaspis incompleta Walker.

(Fig. 3, *d* ; fig. 4, *a* ; fig. 5, *c* ; fig. 7, *g*.)

Dull brown, a stripe along the basal half of the costa, another down the middle of clavus, and two spots level with the apex of clavus, one at the costal margin and one at the inner margin, pale yellow. Metapleura posteriorly yellow. Tibial spines and tarsi dark brown, except the base of the first tarsal segment of the hind leg, which is paler. Anterior lateral margins of vertex fulvous. Pubescence similar to that of *terrea*. Frons feebly prominent.

Described from the holotype, which is a female from Para.

Male, venter dull orange (instead of dull brown). Pubescence sparser. Described from allotype, selected from a series of Para specimens to agree with the holotype. The male genitalia are drawn from a Tapajoz specimen, but the allotype was dissected and compared.

Length, male 8·5 mm., female 9·0 mm.

The holotype and only material of *T. diluta* Walker is synonymous with this species. It comes from the Amazon, locality unspecified.

In fresh examples of both sexes the venter is orange-brown, and in some specimens there is a small oblique pale spot lying along the claval margin of the corium, slanting anteriorly towards the costa.

Redescribed from six males and three females from Para and Rio Tapajoz (Fordlandia). It frequents forest clearings and margins.

Tomaspis picklesi, sp. n.

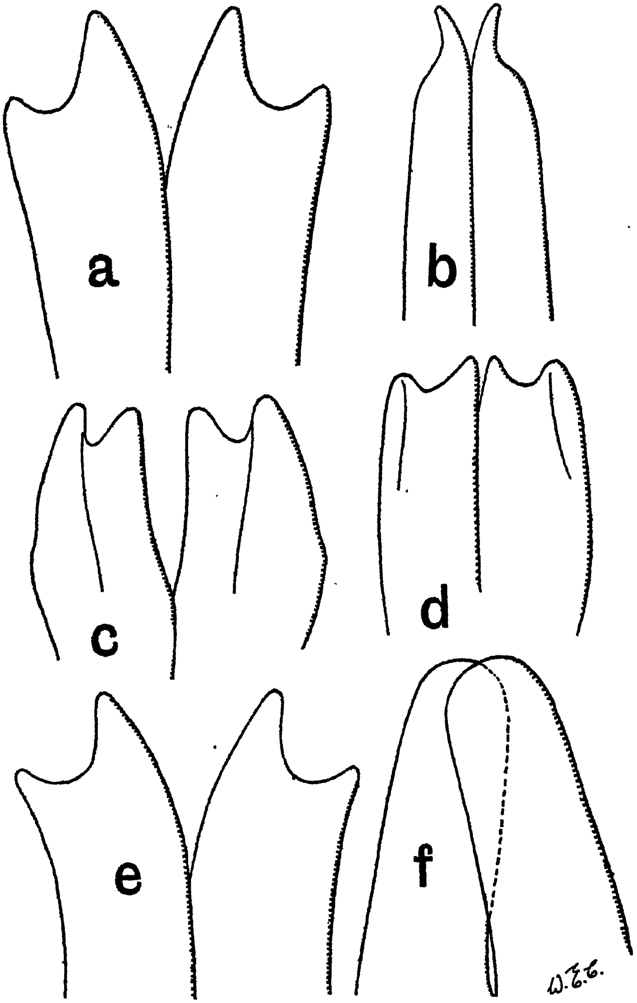
(Fig. 3, *e* ; fig. 4, *b* ; fig. 5, *d* ; fig. 7, *f*.)

Rather dark shining brown, eyes and vertex nearly black, the tegmina pale yellowish brown, with a stripe along the basal half of the costa, another down middle of clavus, becoming obsolete beyond the middle, pale yellow, the area between the two stripes dark brown. The inner angle of clavus along apex of scutellum also infuscate. Spines of tibiæ and the tarsi, except base of first segment (in hind tarsi), dark brown. Venter dark ferruginous brown. Frons feebly globose. Pubescence as in *terrea*.

Male genitalia as figured (holotype).

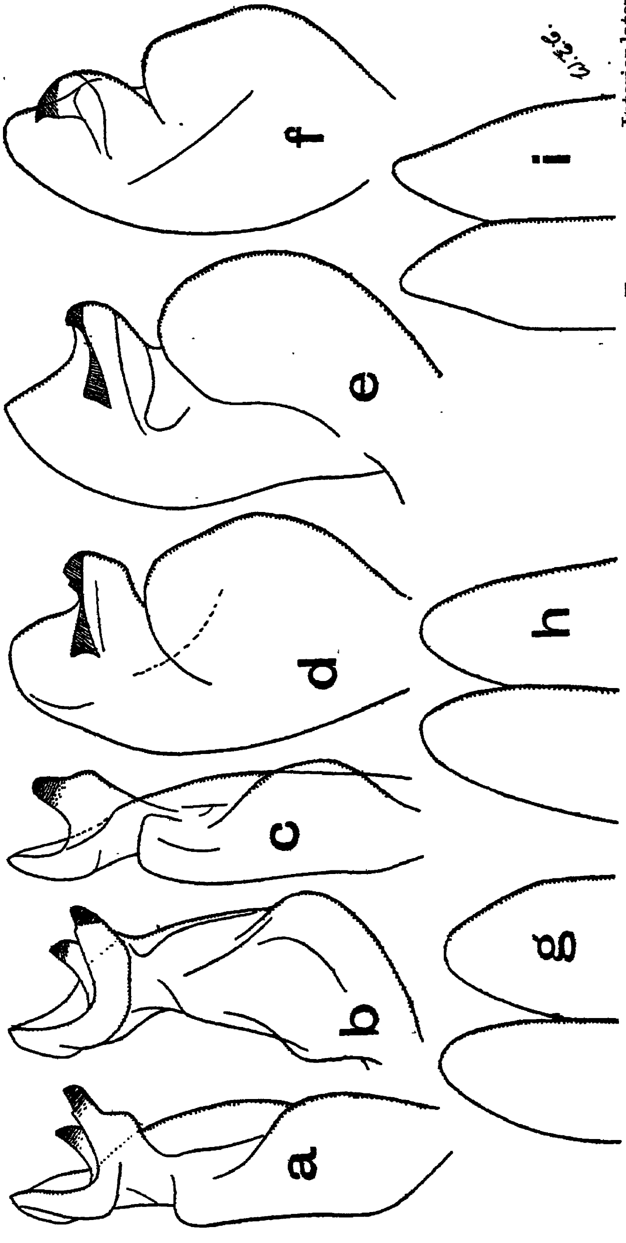
Length, male 7·2 mm., female 7·7 mm.

Fig. 5.



Apices of male subgenital plates:—*a. Tomaspis terrea* Germ.; *b. T. rhynchosporæ*, sp. n.; *c. T. incompleta* Walk.; *d. T. picklesi*, sp. n.; *e. T. morialis*, sp. n.; *f. T. radicis*, sp. n.

Fig. 6.



Dorsal view of left-hand male paramere:—*a. Tomaspis tristis* F.; *b. T. guppyi* Urich; *c. T. mura*, sp. n. Interior lateral view of left-hand male paramere:—*d. T. tristis* F.; *e. T. guppyi* Urich; *f. T. mura*, sp. n. Apices of male subgenital plates:—*g. T. tristis* F.; *h. T. guppyi* Urich; *i. T. mura*, sp. n.

Holotype and *allotopotype*, Santarem, Amazon (*J. G. Myers*).

Described from one male and eight females, all topotypical. This species, which is purely a savannah form, associated especially with the grass, *Paspalum carinatum*, is dedicated to Mr. A. Pickles, Entomologist to the Trinidad Sugar-Cane Investigation Committee, in recognition of his intensive ecological studies of this and other froghoppers in the neighbourhood of Santarem.

The *Tristis* Group.

Tomaspis tristis Fabr. (Fig. 6, *a*, *d*, & *g*; fig. 7, *a*.)

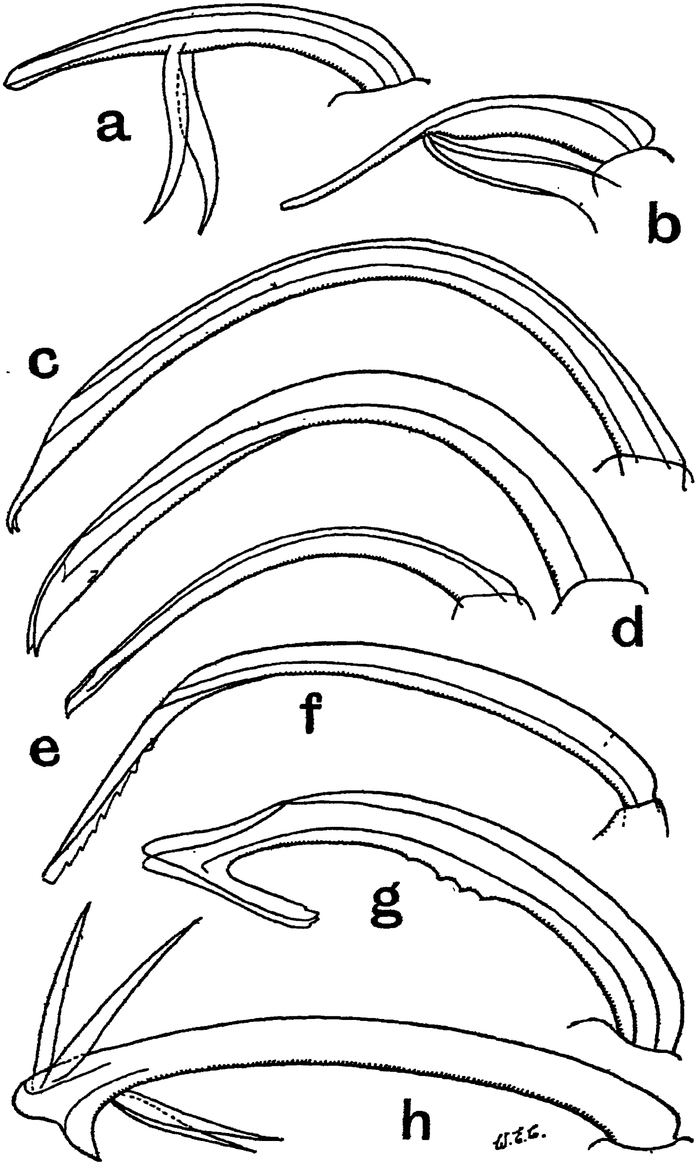
As there is a good figure of both sexes in Williams' paper (1921, pl. i. figs. 16, 17) it is not necessary to redescribe this species, which was described by Fabricius from South America, locality not specified; but Stoll's figure, to which Fabricius referred in his original description, was based on a specimen from Surinam, as were also Williams' illustrations. We have material from Trinidad, British Guiana, and the Lower Amazon, and have selected a male plesiotype from Santarem, as agreeing closest with Stoll's plate. The male genitalia are figured from this specimen. There is a striking sexual dimorphism in colour and pattern, well shown in Williams' plate.

T. guppyi Urich, of Trinidad, appears to us indistinguishable from *tristis*, and the male genitalia (fig. 6, *b*, *e*, & *h*), dissected from a topotype specimen, agree very well. *T. semifascia* Walker (1859), from Para, Brazil (holotype), is also synonymous. *T. suffusa* Walker, of which the holotype male is from an unknown locality, is distinctly the same species, and we have figured the ædeagus (fig. 7, *a*) as typical of the *tristis* group. *T. stellata* Walker, holotype female from Para, is almost certainly synonymous with *tristis*, and *T.* 12-*punctata* Walker, holotype from Cuenca, agrees doubtfully with this.

Tomaspis mura, sp. n. (Fig. 6, *c*, *f*, & *i*.)

Male similar to *tristis* (especially to the female thereof), but colour paler and markings more obscure, and the basal region of the tegmina in front of the three anterior spots is entirely pallid. Frons, pleura, and legs sordid yellow. Apices of tibial and tarsal spurs black. Venter

Fig. 7.



Male ædeagus seen from the left :—*tristis* group : *a. T. suffusa* Walk. (=*tristis* F.). *saccharina* group : *b. T. flavilatera* Urich. *terrea* group : *c. T. terrea* Germ. ; *d. T. morialis*, sp. n. ; *e. T. rhynchosporæ*, sp. n. ; *f. T. picklesi*, sp. n. ; *g. T. incompleta* Walk. Isolated species : *h. T. radicis*, sp. n.

dull brown, posterior margins of segments paler. Pubescence as in *tristis*. Shape of frons also similar, but vertex shorter and more rounded apically than in *tristis*.

Male genitalia as figured (holotype).

Female without the pale basal region of tegmina.

Length, male 11·0 mm., female 11·4 mm.

Holotype and *allotopotype*, Parana do Ramos, Lower Amazon (*J. G. Myers*).

Described from two males and five females from the Lower Amazon (Parana do Ramos and Santarem) and "Santo Paulo, Amazones" (*sic*), the latter an old specimen (1879).

The specific name is that of a formerly dominant tribe of Amazonian Indians.

ISOLATED SPECIES.

Tomaspis radicis, sp. n.

(Fig. 3, *f*; fig. 4, *f*; fig. 5, *f*; fig. 7, *h*.)

Black or dark brown. Anterior lateral margins of vertex in front of eyes, a median longitudinal stripe down the frons, the lateral margins of the pronotum, two narrow undulating transverse fasciæ on tegmen (one just below apex of scutellum, the other level with apex of clavus), a small area near base of claval suture, bright red. Front and middle legs dark brown, hind legs and bases of front and middle tibiæ ferruginous. Metapleura and abdomen bright red. Pubescence moderately dense and much longer than in *tristis* or *terrea*. Frons moderately globose, not angularly prominent as in *tristis*. Hind tibial spines very long.

Male genitalia as figured (holotype).

Female resembles male.

Length, male and female, 12 mm.

Holotype and *allotopotype*, Turu, North-west District, British Guiana (*J. G. Myers*).

Described from two males and two females, all from British Guiana of North-west District, Mazaruni Head, and near Roraima.

This is an exclusively virgin rain-forest species, the spittle-masses occurring on the forest-floor, attached to roots of unknown trees.

Very similar in general appearance to *T. undulata* Lall., but the transverse fasciæ are somewhat broader and less sinuate than in this species. The frons is more globose and less angular in our species. The only available material of *undulata* is the holotype (with abdomen missing) from Ecuador (Province of Tungurahua, *J. B. Rover*).

Tomaspis rubra Linn.

Linnæus states, in the original description, "habitat in America." The type is not among the Linnean material in London.

Tomaspis lineola Fabr.

In the 'Genera Insectorum' (fasc. 143, pl. iv. fig. 7) this well-marked species is figured as *T. lineolata* Am. & Serv., which it does not resemble. Schmidt (1920, p. 66) has already pointed out that this figure is not *lineolata*.

Synonymic List of Species considered.

Tomaspis saccharina Distant.

Ann. & Mag. Nat. Hist. (8) vol. iii. p. 196 (1909).

T. carmodyi Kershaw.

Dept. Agric. Trinidad, Special Circ. 6, p. 5, figs. 4, 10 (1913).
Bull. Ent. Res. vol. iv. p. 143 (1913).

T. bodkini Williams.

Dept. Agric. Trinidad & Tobago, Mem. 1, pl. i. fig. 6 (1921).
Pickles, Stylops, vol. i. pt. 1, p. 14, fig. 1 (1932).

T. propinqua Walker.

List Hom. B.M. pt. 3, p. 671 (1851) (*Triecphora*).

T. demissa Walker.

List Hom. B.M. pt. 3, p. 684 (1851) (*Monecphora*).

T. semifascia Walker.

List. Hom. B.M. pt. 3, p. 679 (1851) (*Monecphora*).

T. postica Walker.

List Hom. B.M., Suppl. p. 177 (1858) (*Monecphora*).

T. flavilatera Urich.

Bull. Ent. Res. vol. v. p. 43, figs. 1, 2 (1914).

T. terrea Germar.

Mag. Ent. vol. iv. p. 46 (1821) (*Cercopis*).

T. morialis C. & M., sp. n.

T. rhynchosporæ C. & M., sp. n.

T. incompleta Walker.

List Hom. B.M. vol. iii. p. 684 (1851) (*Monecphora*).
T. diluta Walker, Ins. Saund., Hom. p. 92 (1858) (*Sphenorhina*).

T. picklesi C. & M., sp. n.

T. tristis Fabr.

Syst. Rhyng. p. 90 (ii.) (1803) (*Cercopis*).
Stoll, Cig. pl. xvi. fig. 88 (1788).
T. semifascia Walker, Ins. Saund., Hom. p. 88 (1858) (*Sphenorhina*).
T. suffusa Walker, List Hom. B.M. pt. 3, p. 689 (1851) (*Sphenorhina*).
T. stellata Walker, List Hom. B.M. pt. 3, p. 691 (1851) (*Sphenorhina*).
T. guppyi Urich, Bd. of Agric. Trinidad, Circ. 9, p. 30, fig. 6 (1913).
? *T. 12-punctata* Walker, Ins. Saund., Hom. p. 90 (1858) (*Sphenorhina*).

T. mura C. & M., sp. n.

T. radicis C. & M., sp. n.

T. rubra Linn.

Syst. Nat. 12th ed. vol. i. pt. 2, p. 711 (1767) (*Cicada*).

T. lineola Fabr.

Syst. Rhyng. p. 94 (33) (1803) (*Cercopis*).
T. lineolata Lall. (nec Am. & Serv.), Gen. Ins. fasc. 143, pl. iv. fig. 7 (1912).

T. pubescens Fabr.

Syst. Rhyng. p. 93 (24) (1803) (*Cercopis*).

ADDENDUM.

The Cercopid generic name *Lallemandia* China, Bernice P. Bishop Museum, Bull. 113, Pacific Ent. Survey Publ. 6, art. 8, p. 39, 1933, is preoccupied by the Membracid genus *Lallemandia* Funckhouser, Journ N.Y. Ent. Soc. xxx. p. 33, 1922, and is herewith renamed *Lallemandana*, nom. nov.

XLVII.—*A new Grasshopper Genus of intermediate Subfamily Characters, and other interesting Orthoptera from Morocco.* By B. P. UVAROV.

OWING to the kindness of Monsieur P. Regnier I have received some Orthoptera collected by his collaborators, mainly by Monsieur Rungs, in various parts of French

Morocco. Of particular interest were M. Rungs' captures in the recently pacified areas of the southern Moroccan Sahara, which still remains practically unexplored.

Apart from several species not yet recorded from Morocco, the collection included a specimen of a remarkable wingless grasshopper, which it proved difficult to place in one of the recognized subfamilies of Acrididæ, while it exhibited characters of two distinct subfamilies at the same time.

The presence of several species new to the country in this relatively very small collection indicates that the Orthopterous fauna of Morocco is still far from being exhausted by the recent studies of Werner, and the latest total of 252 species (Werner, Sitzber. Akad. Wiss. Wien, mat.-nat. Kl. Abt. i. vol. cxli. 1932, p. 112) cannot yet be regarded as approaching the final.

It is to be hoped that a thorough exploration of the southern territories will be undertaken by resident entomologists, and particular attention paid to small wingless forms.

Acrididæ.

ANAMESACRIS *, gen. nov.

Although lacking the prosternal tubercle, this genus should be placed in the subfamily Catantopinæ next to the genus *Dericorys*, from which it differs by the fusiform apterous body, the absence of the abdominal tympanum, and the structure of the vertex.

Antennæ short and thick, rounded.

Face oblique. Frontal ridge somewhat projecting forward between the antennæ, forming a distinct, if obtuse and rounded, angle with the fastigium of vertex. The anterior part of the fastigium is flat and almost horizontal, forming an angle with its posterior part, which is convex; the horizontal part is split into two by a fine median furrow continuing a very short way down the frontal ridge; the convex posterior part with a low median carinula continued on to the occiput.

Pronotum thick, conical, not constricted, with a low hump in the prozona. Median carina low, thick, with a fine sulcus along the middle, intersected only by the typical sulcus, which is placed far behind the middle. Hind margin obtusely excised in the middle, with the sides rounded.

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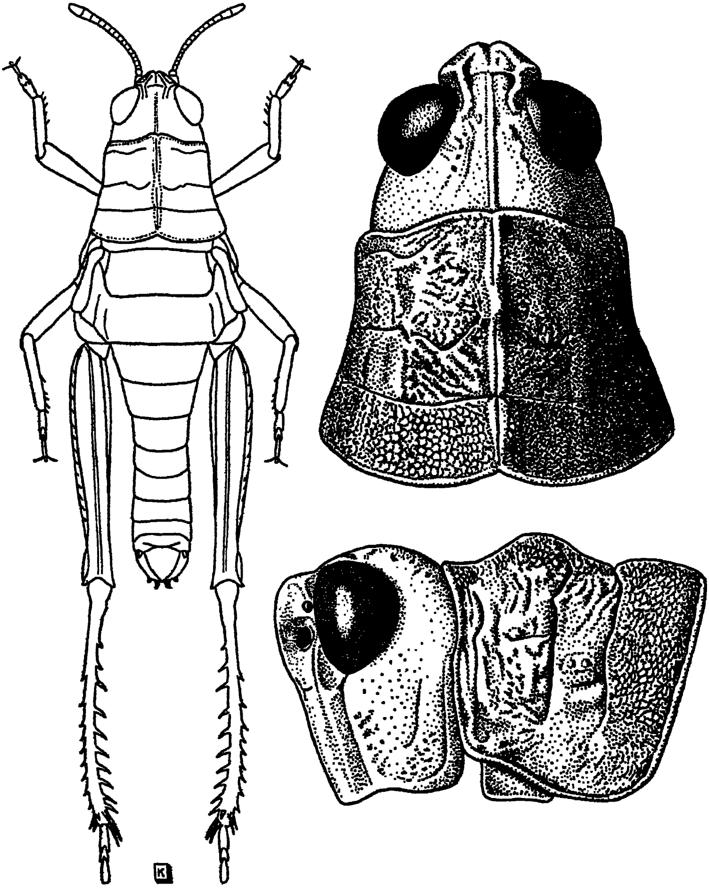
* An Acridid of intermediate characters.



Anamesacris saharæ, gen. et sp. n., ♀.

Prosternum very slightly incrassate anteriorly, without a tubercle. Mesosternal lobes small, rounded, very broadly separated. Metasternal lobes broadly separated.

Abdomen tapering from the inflated mesothorax, metathorax, and the first tergite to the apex. Tympanum represented by a minute opening.

Valvæ of the ovipositor short, with strong basal teeth, the upper ones almost concealed under the parts of the last tergites.

Hind tibia slightly curved, armed with the apical spines on both sides. Arolia between claws of all legs very small.

Anamesacris saharæ, sp. n.

♀.—Antennæ not reaching beyond the middle of the pronotum, slightly incrassate towards the apex.

Face and lower part of cheeks callously rugose. Frontal ridge moderately expanded between antennæ, constricted under the ocellum, and strongly expanded towards the clypeus, its surface slightly concave, the margins thick, rounded. Lateral facial keels thick, irregularly rounded-angulate. Fastigium of vertex broadly pentagonal, with the apex concave and incised.

Pronotum densely covered with low, rounded, callous tubercles, which are more or less elongate transversely in the prozona and more round in the metazona, where they are placed more densely and confused.

Mesonotum, metanotum, pleuræ, and the first tergite confusedly rugulose and punctured, with a faint trace of a low median carinula.

General coloration greyish-buff. Hind femur with three faintly visible brownish fasciæ above. Hind tibia with the spines bright red in their basal halves and black apically; the inner ones each provided with a small black spot inwards of the base.

Length of body 24; pronotum 5; hind femur 11 mm.

Described from a single female taken at Tafilalet, Moroccan Sahara, in May 1933 by M. Rungs.

Type in the British Museum of Natural History.

The affinity of this extraordinary insect to *Dericorys* is beyond any doubt, and is evidenced by the structure of the frontal ridge, the vertex, the pronotum, and the hind tibia; at the same time the new genus exhibits a number of characters which appear to suggest that it is not even a true member of the subfamily Catantopinæ. To begin with, the structure of the prosternum, which has no trace of the typical tubercle, would not permit the inclusion of *Anamesacris* into Catantopinæ if this character is taken as an absolute one. However, a tendency to the disappearance of the tubercle is observed in some true Catantopinæ, and in the genus *Dericorys* there is one species, *D. ramachandrai* Uv. (Ann. & Mag. Nat. Hist. ser. 10, xi. 1933, p. 249), in which the prosternum bears only a very low tubercle; it is noteworthy that in *D. ramachandrai* the elytra are somewhat abbreviated, and *Anamesacris* shows both a complete disappearance of elytra and wings and the absence of prosternal tubercle.

Another remarkable feature of *Anamesacris* is the apical furrow of the fastigium of vertex. In all Catantopinæ the fastigium is either strongly sloping, its surface being continuous with that of the frontal ridge, or it is separated from the ridge by a transverse carinula. It is only in the South American *Diedronotus* and allied genera that the fastigium of vertex has an apical furrow. This furrow is not such an insignificant character as it may appear, since a well-developed median furrow of the vertex constitutes one of the few characters by which the subfamily Pamphaginæ is distinguished. In other words, the presence of the furrow in *Anamesacris* can be regarded as a definite indication of its relationship to Pamphaginæ. Another point of affinity of *Anamesacris* with the same subfamily, if less convincing, can be seen in the shape of the frontal ridge, which is prominent between antennæ and forms an angle with the fastigium; this is, again, a feature peculiar only to a section of Catantopinæ, usually placed at the beginning of the subfamily. The short moniliform antennæ of *Anamesacris* cannot be claimed as a non-Catantopine character, but this type of antenna is more common in Pamphaginæ.

The affinity of *Anamesacris* to Pamphaginæ is particularly striking when that genus is compared with the curious little genus *Pamphagulus*, one species of which has been recently described by myself from Sinai (see Bodenheimer and Theodor, ‘Ergebnisse der Sinai-Expedition,’ Leipzig, 1929, p. 99) and two more by Ramme from Mauretania (Mitt. Zoolog. Mus. Berlin, xvii. 1931, pp. 193, 195). The structure of the vertex in *Pamphagulus* clearly represents a further development of the type observed in *Anamesacris*, the horizontal anterior portion becoming still more sharply separated from the convex posterior portion, and the lateral margins, in consequence, becoming more angular in profile near the eyes. The pronotum of *Pamphagulus*, particularly in the two species of Ramme, does not differ from that in *Anamesacris*, and the same is true with regard to the prosternum, which is unarmed in both genera.

Although the position of *Pamphagulus* in the subfamily Pamphaginæ is a somewhat isolated one, there can scarcely be any doubt that the genus belongs to that subfamily. Therefore we have in *Anamesacris* a genus which is equally closely related to *Dericorys*, an unquestionable member of Catantopinæ, and to a genus of Pamphaginæ, thus linking up the two subfamilies. This is, of course, not a very unexpected phenomenon, since the subfamily divisions within Acrididæ are mostly conventional, but it is an additional argument against raising subfamilies to a family rank, which policy is not infrequently adopted merely as a result of insufficiently wide knowledge of the group.

The affinities of *Anamesacris* as discussed above permit one to make an interesting suggestion as to the origin of Pamphaginæ. It would appear that the loss of elytra and wings in a *Dericorys*-like insect might lead to an evolution in the direction of Pamphaginæ. When the face becomes more oblique and the frontal ridge more prominent between antennæ the anterior part of the fastigium of vertex sinks in relation to the posterior part and an angle with the frontal ridge is formed. At the same time the sulcus of the frontal ridge maintains its communication with the surface of the fastigium and an apical furrow of the latter is formed; a further development of that furrow would lead to a vertex of the true Pamphagine type. The disappearance of the prosternal tubercle in *Anamesacris*, as we have seen, is foreshadowed already in at least one species of *Dericorys*, while this structure in Pamphaginæ is very variable and often (*e.g.*, in *Glauia*) very similar to that in *Anamesacris*. The variation in the sculpturing of the body from *Dericorys* to *Pamphagulus* is also of interest. In *Dericorys* only a slight granulation of the pronotum can be seen, in *Anamesacris* the whole body becomes rugulose, and *Pamphagulus* is as coarsely rugulose and grained as most typical Pamphaginæ. Too great a stress, however, cannot be placed on this character, since it is known to vary in accordance with the habitat of the insect.

On the whole, the discovery of *Anamesacris* and *Pamphagulus*, even though they cannot be regarded as the forms actually transitional between Catantopinæ and Pamphaginæ, lends a definite support to Saussure's statement that Pamphaginæ are "des Acridiens adaptés au désert" (Spic. Entom. Genav. ii. 1887, p. 11; under "Acridiens" that author understood Catantopinæ).

A discovery of the males in both genera must be awaited with great interest, since their study should throw some new light on the affinities of these remarkable members of the Eremian fauna.

Amismizia puppa I. Bolivar.

Although this curious insect is not in the collection under study I thought it useful to discuss here its affinities, which have been misunderstood by previous authors.

I. Bolivar described the genus *Amismizia* as a member of Œdipodinæ related to *Egnatius*, but the insect lacks the most essential character of Egnatiini, viz., the inflexed mesosternal furrow. Moreover, the only reason for placing *Amismizia* in Œdipodinæ is the almost vertical frons, which is a character of very doubtful value. The author of the genus noticed the great resemblance of *Amismizia* to *Pezotettix* of Catantopinæ, but apparently hesitated to include it in the latter subfamily because of the absence of a definite prosternal tubercle. That tubercle, however, is not an absolute character of the subfamily Catantopinæ (see above), and the perceptibly swollen prosternum of *Amismizia* permits us to regard it as unquestionably a member of that subfamily. In the present system it should be placed in the immediate vicinity of *Pezotettix*.

Werner's suggestion (Sitzber. Akad. Wiss. Wien, mat.-nat. Kl. Abt. 1, cxli. 1932, p. 148) to include *Amismizia* in Pamphaginæ is unacceptable, since in the structure of the vertex there is not the slightest resemblance to that subfamily, and the shape of the male subgenital plate as described by him in *Amismizia* is not a character of Pamphaginæ alone.

I am grateful to Prof. F. Werner for a specimen of this species.

Sphingonotus diadematus Vosseler, 1902.

Ain Kanaiba, Morocco, 19. vi. 1933.

The first record for Morocco of this species, described this from the Algerian Sahara.

Sphingonotus luteus Krauss, 1893.

Midelt, 4. vi. 1933.

Known from Oran and Aumale in Algeria; new for Morocco.

This species is usually regarded as a mere colour-form of *S. azurescens*, but it appears safer to consider them separately, since the systematics of the genus *Sphingonotus* are in a most unsatisfactory state, and the name *azurescens* has been applied to more than one species.

Eremogryllus quadriocellata (Werner).

1932. *Leptopternis quadriocellata* Werner, Sitzungsber. Akad. Wiss. Wien, mat.-nat. Kl. Abt. i. Bd. cxli. p. 146, fig. 10.

Ouihalam, Moroccan Sahara, 16. v. 1933, 1 ♂.

Werner described his species without stating the sex of the types, but in a letter he informed me that they were females. The male before me now unquestionably belongs to the same species, while its study permits me to refer the species to the genus *Eremogryllus* of Krauss because of the characteristic genitalia. The species differs from *E. hammadæ* Krauss by the lateral pronotal carinæ being distinct, though only in the region of the pale spots near the front margin of both the prozona and the metazona. Measurements as in *E. hammadæ*.

Tettigoniidæ.

Phaneroptera albida Walker, 1869.

Erfoud, Tafilalet, 15. v. 1933.

This species has been known only from Egypt and Arabia (see Uvarov, Bull. Min. Agr. Egypt, no. 41, 1924, p. 9), and its discovery in the Moroccan Sahara proves that the area of its distribution stretches across the continent of Africa.

XLVIII.—*Two Additions to the Pleistocene Cave-fauna of Palestine* (Trionyx *and* Crocodilus). By DOROTHEA M. A. BATE, Department of Geology, British Museum (Nat. Hist.).

[Plate XIII.]

GREAT quantities of animal remains have been obtained from the Athlit Caves near Mount Carmel during the excavations which are being carried out by the British School of Archæology in Jerusalem with the collaboration of the American School of Prehistoric Research, under the leadership of Miss Dorothy A. E. Garrod.

It will be some time before a detailed examination can be made of the numerous specimens included in the collection, but it has already been possible to gain some idea of the general trend of changes in the faunas of the various periods represented.

It has been indicated in a previous note (Bate, 1933) that the faunal assemblage of Mesolithic times differed considerably from that of Palestine at the present day. As work continued through layers containing cultural remains of Capsian, Aurignacian, Upper Mousterian, and Lower Mousterian type, so the accompanying faunas show certain differences and changes. In the Mesolithic deposits gazelles were the dominant species, and the mammalian fauna as a whole suggests an open savannah type of country with neighbouring forests.

In the Upper Mousterian layers of the Tabun Cave, which are nine or ten feet thick and represent the lapse of a long period of time, the mammalian remains are almost entirely those of deer. This seems to indicate a plentiful rainfall in a well-wooded country.

In the Lower Mousterian, represented by the Mugharet-es-Sukhul deposits (B), and by layers C and D of Tabun, although deer and gazelle etc. are present, a very great difference is seen in the fauna, and there are a number of species which have not been found in the more recent layers. Among the mammals the most noteworthy of these are rhinoceros, hippopotamus, and wart-hog.

During the excavations carried out in 1933 remains of river-turtle (*Trionyx*) and crocodile were discovered in these Lower Mousterian layers (C and D) of Tabun. No remains of either of these animals had previously been obtained from the Pleistocene of Palestine. Species of each of these genera need water in considerable quantity. It seems, therefore, necessary to postulate for the Palestine of Lower Mousterian times fairly open low country with perennial large rivers and marshes, while forests crowned the hills and mountains.

Although the fact has been disputed or ignored by some authors, it is a matter of common knowledge that crocodiles are found at the present day, or at all events existed until within a few years, in the marshes of the Zerka River, not far from Haifa; while river-turtles (*Trionyx*) still live in the Nahr el Kelb, a few miles north of Beirut. The question naturally arises as to whether these are survivals from the richer fauna of the Lower Mousterian of Palestine, or whether the specimens now inhabiting these localities have found their way direct from the North African coast (see Flower, 1933, p. 754). It seems as if further discoveries will be needed to finally decide this point.

Trionyx sp. (Pl. XIII. figs. 2–4.)

Seven fragments of *Trionyx* shell were obtained from Tabun, six of these from Level C and the seventh from Level D. All bear the characteristic raised vermiculated pattern, but the pieces themselves are so small that their original position in the carapace or plastron is not always certain. Both the grooved anterior margin of the bone and the pattern of the ornament in the single specimen from Level D suggest that it is the antero-external portion of the left xiphiplastron. The largest specimen from Level C may possibly represent the inner border of a left hypoplastron. The specimens from Level C, like many of the associated bones, are a rich chestnut-colour, which may be given a highly polished surface by rubbing. The bone from Level D is greyish brown in colour.

All the specimens are thick, indicating animals of considerable size; one piece has a maximum thickness of 14·3 mm., while the smallest has a maximum thickness of 9·7 mm. A fragment of a costal plate of a very aged individual from Arabia in the British Museum Collection (R. 52) of unknown geological age or definite locality has a maximum thickness of 13·4 mm.

It has not been found possible to determine the Palestine Pleistocene *Trionyx* specifically, for the material is very fragmentary, and the pattern of the shell ornament varies considerably in any one species.

Remains of *Trionyx* are commonly found in early Tertiary deposits of Europe, but the genus seems to have ceased to exist there by the end of Pliocene times, if not earlier. Pieces of *Trionyx* shell are commonly found in Pleistocene deposits in Africa, but I have not yet had the opportunity of examining any.

The great importance of the discovery of *Trionyx* in the Pleistocene of Palestine lies in the bearing its presence has on the question of the climate of the country at that period. It seems that there can be no doubt that this animal, although tolerant of low temperatures, cannot exist where there is not plentiful water, and one could not expect to find it living commonly in Palestine proper at the present day. Coastal Syria has a much more plentiful water-supply than Palestine, and the present home of *Trionyx*, the Nahr el Kelb, has a very powerful flow of water.

In his Monograph on the Trionychidæ, Hummel (1929, p. 428) says that where fossil Trionychia are found they are an indication of the existence of permanent running water ; as a rule, they suggest a damp or at least semi-damp climate. While they are not very susceptible to temperature, for they are found native in both the St. Lawrence and Amur Rivers, the migrations and distribution of *Trionyx* are governed by the presence of rivers, with the additional aid of seas which may be made use of for quite long journeys.

Trionyx has been claimed to exist in the Sea of Galilee (Lortet, 1887, p. 24, and Siebenrock, 1913), but apparently so far on insufficient evidence, and in this connection it may be worth noting that Tristram (1884, p. 157), in writing of *Emys europœa*, says :—“ This large Water Tortoise inhabits the Lakes of Gennesaret and Huleh, where it attains a great size.”

Crocodilus sp. (Pl. XIII. fig. 1.)

At present the crocodile from the Pleistocene of Palestine is represented by a single specimen obtained in 1933 from the Lower Mousterian Layer C of Tabun. This specimen is a complete dorsal scute having a maximum antero-posterior length of 40 mm. and a maximum width of 56 mm. In appearance it closely resembles some corresponding bones of *C. niloticus*, but Mr. H. W. Parker tells me that the sculpture of these scutes is very variable, and useless for specific determination. This new discovery of crocodile remains is of great interest both with regard to the earlier distribution of the species and to its association in the Lower Mousterian with other animals whose presence not only indicates a more humid climate than that of to-day, but also a closer faunal relationship between Palestine and Africa at that time.

I have already referred above to the occurrence of crocodiles in Palestine at the present day. Major Flower (1933, p. 755), among others, accounts for this by the sporadic straying of specimens from the Nile. Crocodiles have been established in some marshes of Palestine for so long that it seems rather open to doubt if the species were not more firmly established than the theory of straying individuals from the Nile would lead one to suppose.

Since the time of Pliny and Strabo many authors have written of the crocodiles of the marshes of the Zerka River, among whom mention may be made of Pococke (1745, p. 58), Roth (1858, p. 112), Böttger (1880), Tristram (1898, p. 261), Anderson (1898, p. 27, and perhaps in the river Jordan), Schumacher (1903), and Masterman (1921). Several specimens of the animal itself and of its eggs have been preserved or seen by reliable witnesses, and there is a stuffed example preserved in London in the Museum Offices of the British School of Archæology in Jerusalem.

In connection with the present-day isolated position of crocodiles in Palestine, and also the indication of a former closer faunal relationship with Africa, it is of interest to remember that these animals are also still found living in isolated sheets of water far inland in Southern Algeria and French Mauritania (Pellegrin, 1913, p. 347, and Staudinger, 1929, p. 141). So far as I am aware, no fossil remains of crocodile have as yet been found in Northern Africa.

In conclusion, I should like to express my thanks to Dr. W. E. Swinton for giving me facilities for comparing my specimens with those in his charge, and also to Mr. H. W. Parker for first drawing my attention to

some of the papers relating to the subjects of this note, as well as for his interesting and suggestive papers on the distribution of some Recent reptiles in Arabia and Somaliland.

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EXPLANATION OF PLATE XIII.

Fig. 1. *Crocodilus* sp. Dorsal scute.
Fig. 2. *Trionyx* sp. Fragment of carapace.
Fig. 3. *Trionyx* sp. Fragment of carapace, seen in vertical section.
Fig. 4. *Trionyx* sp. ? Distal portion of a costal plate.

These specimens were all obtained in Level C of the Tabun Cave, and were associated with a Lower Mousterian Industry.

All figures are of natural size.

XLIX.—*Two new Species of* Adoretus (*Col.*, Scarab., Rutelin.) *from Eastern Africa.* By F. OHAUS.

1. *Adoretus myodes*, sp. n.

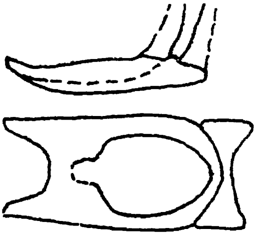
A. pubiventris Lap. proxime affinis, differt præcipue femoribus pedum anteriorum et intermediorum flavidis.

Long. 11–13·5, lat. 5–6 mm. ♂♀.

BRIT. E. AFRICA: Kaimosi, iii.–iv. 1932 (A. Turner coll.).

Oblong-ovate, feebly convex, upper and underside piceous-black, the anterior and middle femora alone yellowish, feebly shining, and clothed everywhere with short greyish hairs. Clypeus semicircular in both sexes, finely bordered. Thorax more than twice as broad as long, like head and scutellum densely and confluently punctured. Elytra with convex primary costæ, the primary rows of punctures limiting the costæ finely sulcate, while the flat interstices are densely and rugosely punctured; the greyish hairs, decumbent on the head and thorax, are more erect on the elytra and here more densely set on the apical callus and on the hind border, as on the pygidium. The legs are stout, the three teeth on the anterior tibiæ at equal distances. The shape of the ædeagus shown in fig. 1.

Fig. 1.



Ædeagus of Adoretus myodes, sp. n.

♂.—Body parallel-sided and flattened; eyes larger and more prominent; antennal club as long as the stem; pygidium convex.

♀.—Body more ovate and more convex; antennal club shorter than the stem; pygidium more flattened and abdomen more convex.

2. *Adoretus rhamphomorius*, sp. n.

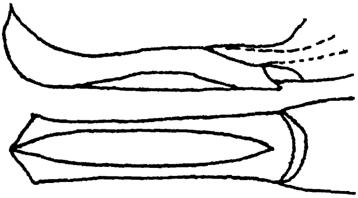
A. ictericus Burm. proxime affinis. Oblongo-ovalis, parum convexus, supra et subtus flavo-testaceus subnitidus, pilis brevibus griseis appressis undique sparsim vestitus.

Long. 11–13·5, lat. 6–6·5 mm. ♂♀.

E. AFRICA: Kilimandjaro: Moschi; Kenya Colony: Watita Hill, Kedai (C. Montague Smith coll.); Kibwezi, xi. 1929 (Dr. van Someren coll.); Ikutha; Mombasa.

Oblong-ovate, somewhat flattened above, upper and underside testaceous, feebly shining, densely and confluently punctured, and clothed with short greyish hairs. Clypeus trapezoidal, with feebly rounded angles in the ♂, semicircular or even parabolic in ♀, the blackish border distinctly elevated. Thorax more than twice as broad as long, anterior angles acute and distinctly produced, obtuse posterior angles not rounded, lateral margins finely crenate, and lateral sulcus broad. On the elytra the primary costæ are here and there evanescent and not very convex, while the primary rows of punctures are regular. Front tibiæ with very stout apical and intermediate teeth, while the basal tooth is very feeble. Ædeagus as in fig. 2.

Fig. 2.



Ædeagus of *Adoretus rhamphomorius*, sp. n.

♂.—The eyes are somewhat larger and more prominent; antennal club longer and pygidium more perpendicular.

♀.—Body stouter and larger, more convex; abdomen more arched.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

No. 83. NOVEMBER 1934.

L.—*Contributions towards a Knowledge of the European Thysanoptera.*—V. By RICHARD S. BAGNALL, D.Sc., F.R.S.E.

THIS is continued from Ann. & Mag. Nat. Hist. ser. 10, xi. pp. 647–661 (June 1933), and contains the descriptions of *Rhipidothrips uzelianus*, *Æolothrips pyrenaicus*, *Æ. bucheti*, *Melanothrips bisetosus*, *M. thymicola*, *Odontothrips brevipes*, *O. vuilleti*, *O. ononidis*, *Frankliniella ononidis*, *Phlœothrips gallicus*, *Hapliothrips* (gen. nov.) *globiceps*, *Haplothrips eryngii*, and *H. nigricans*, spp. n.

Of these *Rhipidothrips uzelianus*, *Æolothrips pyrenaicus*, and *Odontothrips brevipes* are described from my old unworked material; the rest, together with records of many rare and little-known species, are due to the energies of the late André Vuillet, who brought together a large collection, chiefly from France and Africa. In 1914 Vuillet published several memoirs on Thysanoptera, but he had scarcely touched the fringe of his collection when, in the early days of the Great War, he was called to lay down his life for his country.

I am indebted to the Directors of the Société Agronomique for the opportunity of studying this valuable collection.

Suborder TEREBRANTIA.

Family **Æolothripidæ.**

Rhipidothrips uzelianus, sp. n.

♀.—Confused with *R. gratiosus*, and distinguished by the relatively much shorter intermediate antennal joints, the shorter head and tibiæ, and the noticeably narrower fore-wings.

The following are comparative measurements in microns :—

	♀ *gratiosus.*	♀ *uzelianus.*
Length (and breadth) of head to fore-margin of eyes	200 (190)	182 (190)
Median lengths of abdominal tergites 9 and 10	108, 114	105, 95
Lengths of bristles thereon	216, 175–190	195, 162
Length (and breadth) of fore-wing	1050 (150)	945 (128)
Length (and breadth) of tibia i.	175 (65)	150 (58)
" " " ii.	190 (55)	162 (50)
" " " iii.	295 (50)	242 (47)

Lengths (and breadths) of antennal joints :—

R. gratiosus : 30 (40), 52 (31), 100 (24·5), 80 (27), 58–62 (24), 46 (24), 38–40 (22–24·5), 16 (15–16), 11–12 (8) μ.

R. uzelianus : 33 (38), 51 (28·5), 80 (22), 59 (25), 51 (24), 40·5 (23·5), 32 (21), 13·5 (16), 10 (7) μ.

Hab. SWITZERLAND, Uetliberg, Zurich, 1 ♀ on *Brachypodium*, vii. 25 (*R. S. B.*). I also have the species from England.

Æolothrips pyrenaicus, sp. n.

This is a species of the *fasciatus* group with a noticeably transverse head and pronotum, short antennæ, in which the joints 6–9 together are only a little less long than 5, whilst 4 (which is 2·4 times as long as broad) is subequal in length with 5 and 3 is approximately four times as long as broad. The sensory area of joint 4 is short and runs for the distal 0·4 to 0·42 of the joint, whilst the short straight area of 3 does not run beyond the distal 0·3.

The fore-wings are comparatively broad and approximately 5·5 times as long as broad at distal third, and the second bar commences at just before to substantially before the subdistal cross-veins.

The colour is much as in allied species; the fore-tibiæ, especially medianly, and the fore-tarsi are yellowish-brown to yellowish; the second antennal joint is yellowish-brown distally, whilst 3 is creamy-yellow with the distal fourth (0·25) shading from brown to a ring of dark brown at the extreme tip. The fasciæ of the fore-wings are palish grey-brown.

The apical abdominal bristles are fine and subfuscous in colour.

♀.—Length c. 1·4 mm., and breadth of pterothorax 0·34 mm.

The following are the measurements in microns of the type-specimen:—

Length (and breadth across eyes and basally) of head 128 (168 and 195); length (and breadth) of pronotum c. 135 (c. 250); length (and breadth at distal third) of fore-wing c. 885 (160). Length (and breadth) of tibiæ i. 162 (48); ii. 168 (40), and iii. 270 (38). Median length of ninth abdominal tergite c. 105, and lengths of longest bristles on 9 and 10 160–165 and 190 μ respectively.

The relative lengths (and breadths) of the antennal segments 3–9 are approximately 84 (c. 21), 60 (25), 62 (25), 16 (20), 12·5–13·5 (16), 13·5 (12·5), 12·5 (7) μ.

Hab. FRANCE, Ariége and Pyrénées Orientales: l'Hospitalet and Col de Puymerons at c. 5500–6500 feet, several ♀♀ in flowers of *Cistus* and 2 ♀♀ in *Lotus*; Mont Louis, ♀♀ in flowers of *Cistus*, viii. 26 (*R. S. B.*).

There are only two examples in the Vuillet collection, 1 ♀ from Vendôme on *Lotus corniculatus*, 6. v. 13, and another from Chaumont-en-Vexin on *Sinapis alba*, 18. v. 13.

Æolothrips citricinctus Bagn.

I am still unable to say with any degree of certainty as to whether the pronotum of this species (and of *bucheti*, sp. n., which so closely resembles it) is of a uniform yellow colour or dark with a citrous-yellow anterior belt. The legs are uniformly brown, including trochanters, and the large closely-set trochanters of the fore-pair occupy the presumed dark portion of the pronotum; and even examined as an opaque object under a reflected light I am unable to satisfy myself on this point.

Æ. citricinctus is a more heavily built insect than *Æ. citricollis* Bagn.; the wings are 216 μ wide as against 190 μ, the fore-tibiæ are stouter, the hind tibiæ longer, and, in particular, the antennæ are heavier. The third antennal joint is 30–32 μ in width and only c. 5·0 times as long as broad, compared with 24 μ in width and 5·75 times as long as the breadth in *citricollis*; in *citricinctus* the fourth joint is longer compared with the length of 5, whilst 6 is much larger than in *citricollis.*

♂.—Whilst of the *ericæ* type, the spines flanking the claspers are modified and are in the form of bristles each about 100 μ in length and incurved in its distal third; the longest bristles of tergite 10 c. 190 μ in length.

Æolothrips bucheti, sp. n.

♀.—Much as in *Æ. citricinctus* Bagn., from which it may be separated at once by the antennal characteristics described below.

Length (and breadth) of head 162 (21) μ. Relative lengths and breadths of antennal joints (of type) approximately 38 (c. 40), 70 (31), 135 (28), 128 (27), 100 (29), 24 (22·5), 17 (18), 15·5 (14), 14·5 (8) μ, from which it will be seen that 4 more nearly approaches the length of 3 than in either *citricinctus* or *citricollis.* The sensory area on 3 is comparatively short, c. 42 μ in the type, and only occupies the distal 0·35 of joint; on 4 it is slightly and roundly swollen at apex, where it starts on a raised prominence, and is usually 45–46 μ in length, occupying the distal 0·32 of joint. This organ on either segment is subject to some variation, more especially on 3, where it ranges from 36–42 μ; in one example it is placed well below the apex and is only 24 μ in length, unusually broad, and occupying only the distal 0·26 of joint.

Hab. N. AFRICA, Tangier, ♀♀ with *Æ. citricinctus*, v. 1901 (*G. Buchet*). I have pleasure in naming it after the discoverer.

The following key will serve to separate the species of *Æolothrips* in which the pronotum is yellow or yellowish:—

1. Second antennal joint entirely citrous or pale yellow, or at most lightly shaded basally	2.
Second antennal joint dark	4.

2. Sensory areas of antennal joints 3 and 4 long and fine, reaching into the basal half of the respective joints at least; joint 4 noticeably shorter than 3 .... 3.

Sensory areas shorter, occupying up to the distal third (0·35 and 0·32) or thereabouts of the respective joints; joint 4 but slightly shorter than 3 .... *Æ. bucheti*, sp. n.

3. Form more robust, antennal joints 3 and 4 c. 5·0 and 4·0 times as long as broad respectively; sensory area of 4 running into basal third of joint; joint 6 substantially longer than 7 and not quite as broad as long .... *Æ. citricinctus* Bagn.

Form less robust, antennal joints 3 and 4 very slender, 3 5·75 and 4 about 5·0 times as long as broad; sensory area of 4 running well into basal half (0·6) of joint; joint 6 not much longer than 7 and substantially broader than long .... *Æ. citricollis* Bagn.

4. Antennal joint 3 4·0 times as long as broad and 4 but slightly less; sensory area of 3 occupying the distal 0·3–0·4 of joint, that on 4 roughly claviform and not attaining beyond the distal 0·45 of joint .... 5.

Antennal joint 3 c. 5·0 times as long as broad and 4 about the same; sensory area of 3 not reaching beyond the distal 0·3–0·33 of joint, that on 4 longer and more weakly claviform and reaching to or beyond the basal half (0·5) .... *Æ. fulvicollis* Bagn.

5. Bars of fore-wing longer, the second commencing before the second costal cross-vein. Male *without* incurved spines flanking claspers .... *Æ. collaris* Pr.

Bars of fore-wing shorter, irregular, the second commencing at or about second costal cross-vein. Male *with* stout incurved spines flanking claspers .... *Æ. brevicinctus* Bagn.

Family **Melanothripidæ.**

Melanothrips bisetosus, sp. n.

♀.—This species, now described from the south of France, is apparently the common species in Northern Africa, and has been confused with *M. fuscus* (Sulz.). It is a generally larger and more robust form, and may be known by the relatively longer antennal joints 5–7 and by the *two* long outstanding subapical subfuscous hairs of the outer margin of the posterior tibiæ, the more distal and longer of which is 1·5 times as long as the breadth of the tibia at that point.

Compared with *fuscus* the antennal joints 5–7 are constantly relatively longer, 5 and 6 being 2·4 and 2·6 times as long as broad, as compared with c. 2·15 and c. 2·3 times in *fuscus* respectively. In *fuscus* the *single* outstanding subdistal hair of the posterior tibia is often only 1·1 times, and rarely more than 1·3 times, as long as the breadth of the tibia. The following are the relative lengths (and breadths) of the antennal joints 3–9 of (1) ♀ *M. fuscus* from *Sinapis*; (2 *a*) ♀ *M. bisetosus* from *Raphanus*, and (2 *b*) cleared examples, ♀ and ♂, of *M. bisetosus* from *Pisum sativum* (types):—

(1) ♀: 72 (28), 72 (26), 46–48 (22), 54–57 (24), 36–38 (20), 25 (14·5), 32·5 (12) μ.

(2 *a*) ♀: 71·5 (28·5), 76–78 (27), 55–56 (23), 63–65 (24·5), 43–46 (21), 25 (14·5), 32·5 (13) μ.

(2 *b*) ♀: 73 (28·5), 78–79 (26), 55–56 (21·5), 65–67 (22·5), 43–44 (20), 25–28 (14–14·5), 35 (12) μ.

♂: 62 (25), 62 (21), 47 (17·5), 65 (21·5), 31·5 (17), 21·5 (14), 27 (10) μ.

Hab. FRANCE, Aisne: Dercy, both sexes on *Pisum sativum*, vii. 13 (*L. Bru*); Bouche du Rhône: Carry, both sexes on *Vicia faba*, 25. iii. 13 (*P. Vayssière*); Loire Inférieure: Bouage, both sexes on *Raphanus raphanistrum*, vi. 13 (*Penean*); Côte d'Or: Beaune, ♀♀ only, with *M. fuscus* on *Sinapis arvensis*, i. vii. 13 (*A. Paillot*): Liergues, 9. vi. 27, 1 ♀ by sweeping (coll. *Oscar John*). Also from Morocco, Algeria, and Libyia.

Melanothrips thymicola, sp. n.

♀.—This small species agrees with *M. acetosellæ* John in the unicolorous antennæ and in the general form of the joints, and in the fact that the fore-wings are not hyaline at the base, *but*, like *fuscus* and unlike *nigricornis* Bagn., and both the small species with unicolorous wings (*acetosellæ* and *harrisoni* Bagn.), the posterior tibia is furnished with a long outstanding subapical hair. The sixth antennal joint would seem more consistently to approach the length of 3 and 4, so that 5 is noticeably shorter than any of them. In the ♂ the sixth joint is noticeably longer and larger than either 3 or 4. Compared with *acetosellæ* the longest bristles of the ninth abdominal segment are longer, being 135 μ in length as compared with 100 μ in *acetosellæ*, and about

1·6 times (as compared with 1·24) as long as the tergite. The promienent stout spines of the posterior legs seen at the base of the tarsus and near the apex of tibia without in *fuscus* and *bisetosus* are absent or rather of bristle-form, and the apical spines are also bristle-like and weak, the longest within being about as long as the bristles of the tibia. The subapical outstanding hair is weak and about 1·3 times as long as the breadth of the tibia.

The interocellar bristles are 65 μ in length and much longer than the longest in the postocular series; the antero-angular pronotal bristles are about as long as the interocellars (c. 65 μ), whilst the mid-laterals and postero-angulars are longer and stouter, being about 80–82 μ in length The setæ on the veins of the fore-wing are fine, those on the fore-vein and lower vein near the apex being 50–55 and 50–65 μ respectively.

The relative lengths (and breadths) of the antennal joints 3–9 are approximately, 56 (24), 50 (23), 44 (22·5), 50 (23), 36 (21), 23·5 (14·5), 28 (12) μ.

Total length 1·2 mm.

♂.—Antennal joint 6 approximately subequal to 3 and not considerably swollen.

Hab. FRANCE Alpes-Maritimes: Menton, 2 ♀♀ and 2 ♂♂ on *Thymus vulgare*, 25. ii. 13 (*Vuillet*).

Melanothrips acetosellæ John.

Hab. FRANCE, Seine et Oise: Montmorency, 21. v. 14, 2 ♀♀ by general collecting, with single examples of *M. fuscus* and *Kakothrips* and two *Æolothrips fasciatus* (coll. *Vuillet*).

Melanothrips ficalbii Buffa.

Hab. FRANCE, Ille et Vilaine: Rennes, numerous ♀♀ on *Ranunculus* and *Vinca* and one isolated ♀ on *Rosa*, 4. v. 14 (*Pouillande*).

Odontothrips ulicis Hal.

On *Ulex europæus*.

Hab. FRANCE, Seine: Bois de Vincennes, ♀♀♂, 3. iv. 14, and Loire Inférieure: Vallée du Cens, ♀♀♂, without further data (*Penean*).

Odontothrips cytisii Morison.

On *Sarothamnus scoparius.*

Hab. FRANCE, Seine et Oise: Fontainebleau, ♀♀ only, 13. iv. and 3. v. 14 (*Vuillet*). The first continental record of the species.

Odontothrips meridionalis Pr.

Hab. FRANCE, Gers: Ornezan, both sexes in numbers on *Spartium junceum*, 30. vii. 13; Seine et Oise: Fontainebleau, ♀♀ only on *Sarothamnus* with *O. cytisii*, 3. v. 14 (*Vuillet*). Pyrénées Orientales: Banyuls-sur-Mer, 1 ♀ (casual), 15. vi. 13 (*L. Berland*).

Odontothrips mutabilis Bagn.

Hab. FRANCE, Gers: Ornézan, both sexes on *Ulex nanus*, 4. viii. 13 (*Vuillet*).

Odontothrips anthyllidis Bagn.

Hab. FRANCE, Jura: Lemny, both sexes on *Anthyllis vulneraria*, 23. v. 13 (*Vuillet*).

Odontothrips brevis, sp. n.

♀.—Length c. 1·2 mm.

Very close to the recently described *O. quadrimanus* Bagn., from which it is at once separated by the short tibiæ, especially the intermediate and hind pairs, the latter of which is furnished with only 4 (or 5) spines in the distal third within. It also differs in the relative lengths and breadths of the antennal joints.

The pronotum is strongly transverse; the inner postero-angular bristle is noticably longer than the outer, 74–78 and 58–60 μ respectively, and the inmost pair of minor setæ c. 26 μ long. The costal setæ of the fore-wing number 17–18 and those of the lower vein 12–14, whilst the upper vein is furnished with a series of 4, then 9–11 (usually 11)+1+1 (or +2). The comb of the eighth abdominal tergite is absent except laterally; the longest bristle on segment 9 is 140, and the median dorsal pair of 10 c. 128 μ in length.

The following are the measurements in microns:—

Length (and breadth across eyes and across cheeks) of head. 110 (135, 165); length (and breadth) of pronotum 140 (226), and breadth of pterothorax 272, and of fifth abdominal segment c. 324. Length (and breadth near middle) of fore-wing 770 (c. 55).

The antennæ are missing in one example, and in the type are mounted at an angle, so that the distal joints have the appearance of being slightly distorted; the measurements (compared with ♀ *quadrimanus* m.) can only be regarded as approximately, and the measurements of the ♂ antennæ (which are perfectly displayed in the allotype) are added :—

O. quadrimanus ♀: 26 (34), 35 (29), 65 (25), 60 (23·5), 40 (20), 60 (22·5), 11, 18 μ.

O. brevipes, sp. n., ♀: —, —, 56 (25), 54 (22), 35 (c. 18), c. 52 (c. 21), c. 11, c.15·5.

♂: 21·5 (27), 32·5 (26), 50 (19), 44 (19), 32·5 (16), 56 (19), 8, 13·5 μ.

The lengths (and breadths) of the tibiæ compared with those of *O. quadrimanus* ♀ are as follows :—

O. quadrimanus: i. 148 (50) ; ii. 152–162 (40) ; iii. 216–236 (40–46) μ.

O. brevipes: i. 125–130 (46) ; ii. 110–115 (39) ; iii. 162–170 (39–40) μ.

♂.—Smaller and more slender; second antennal joint pale; *intermediate tibiæ armed* as in *O. quadrimanus*. Structure and chætotaxy of end of abdomen much as in *quadrimanus*; arrangement of the three pairs of spines on tergite 9 approximately as in *quadrimanus*; the inmost the shortest, stout and sharp, c. 20–21 long separated by 38 μ, the second bristle-like, 52 long separated by c. 72, and the outmost stout, c. 24 separated by 100 μ; lateral bristles 98 and 114, and the long, curved, postero-angular bristle about 114 μ.

Hab. Switzerland, Lugano, 2 ♀♀ and 1 ♂, viii. 29 (*J. J. Mann*).

Odontothrips vuilleti, sp. n.

♀.—A small species of the same size as *O. confusus* Pr., and falling in the *inermis* Bagn. group. The unique example is mounted laterally at an angle and the wings are difficult to describe, but they would appear to be dark sooty-grey and to have the basal fourth (0·25) or thereabouts hyaline or pale, much as in *confusus*. *The intermediate and hind tarsi are grey-brown and practically concolorous with the tibiæ*, whilst the fore-tibia and tarsus are pale dirty yellow, with the tibia more or less shaded with brown. The third antennal joint is pale greyish-yellow, 4–8 grey-brown, the fourth being a shade less dark than the following and having the base pale, whilst 5 possesses the usual palish subbasal ring.

The antenna is of normal form except that joint 3 is somewhat strongly arcuate on one side before the subdistal constriction to seat the forked trichome. The fore-leg is of *inermis* form, the tarsus being armed with a very minute tooth, whilst the tibia is apparently simple, as in *edentulus* Pr., the spurs being represented by bristles, one of which, under a high power, is apparently seated on a very minute tooth-like projection.

The lengths of the interocellar and the postero-angular pronotal bristles are c. 80 and c. 75–80 μ, whilst the longest bristles on abdominal segments 9 and 10 are c. 140 and 132 μ respectively. Tergite 8 apparently without comb medianly.

Setæ of fore-wings on costa, upper vein (excluding the basal series), and lower vein (from the commencement of the dark area) numbering 20, 13, and 16 respectively, those of upper vein without substantial subdistal gap.

Relative lengths (and breadths) of antennal joints 3–8 approximately c. 60 (25), 52–54 (23), 40 (20·5), 62 (21·5), 11, 15 μ.

The species can only be compared with *O. inermis* Bagn., (described from a ♂ example found on *Ulex* in the north of England) in which the fore-tibia is unarmed. *O. inermis* differs in having *all* the tarsi yellow and the hind and intermediate tibiæ yellowish at the knees, as well as in several points of detail.

Hab. FRANCE, Pyrénées: Cauterets, 25. v. 13, 1 ♀, on *Astragalus monspessulanus* (*Marg. Vuillet*) with *Æolothrips ericæ* Bagn. and *Thrips* spp.

Odontothrips ononidis, sp. n.

This species comes in the *confusus* Pr.-group, and may be separated from that species by its larger size, the coloration of the antennæ and of the hind and intermediate tarsi; by the less defined and shorter pale basal area of the fore-wings and the larger number of setæ on the veins, which are more closely and regularly disposed than in *confusus.*

♀.—Form broad. Length 1·6–1·7 mm., breadth of pterothorax c. 0·35 mm.

Colour brown, *including the hind and intermediate tarsi* ; fore-tibiæ and tarsi greyish-yellow to yellow ; third antennal joint greyish-white and joints 4–8 lightish brown to grey-brown, not so dark as the head or joints 1 and 2 ; pale area at base of 4 and ring near base of 5 suffused and scarcely noticeable. Fore-wings deep grey-brown, with only the subbasal sixth or thereabouts pale, though not truly hyaline, whereas specimens of *confusus* (from *Medicago*) have the basal fourth hyaline.

Fore-tarsus and tibia as in *confusus.*

Head transverse, c. 140 (190) μ, broadening from behind eyes to base ; interocellars fine, 90–95 μ long. Antenna normal, much as in *confusus.* Postero-angular pronotal bristles only moderately strong, 95–105 μ in length. Veins of fore-wing closely and regularly set with setæ, those of upper vein continuing to end without a noticeable break or gap, the series of the lower vein and the long series of the upper vein numbering 18 and 17–18 respectively.

Tergite 8 medianly without "comb" ; apical abdominal bristles fine, the longest on segments 9 and 10 165–190 and 140–150 μ respectively—that is, approximately the same as in the smaller *confusus.*

Hab. France, Charante-Inférieure : St. George's de Didonne, 5 ♀♀ on *Ononis natrix* Lam., and Meschere, 4 ♀♀ on *Ononis* sp., 15. vii. 14 (*Vuillet*), with *Æolothrips fasciatus* L. and *Frankliniella intonsa* (Tryb.)

Odontothrips quadrimanus Bagn., and *O. thoracicus* Bagn. (two British species belonging to the *loti*-group) have recently been described from *Ononis.*

Odontothrips confusus Pr.

Hab. France, Côte d'Or : Beaune, 2 ♀♀ and 1 ♂ and larvæ on *Medicago falcata,* 1. vii 13 (*A. Paillot*).

Frankliniella ononidis, sp. n.

♀.—Size, general form, and colour (excepting antennæ) as in *F. pallida* Uz. Antenna with joint 1 pale, 2 and 5 to 8 greyish-brown to lightish brown, 5 sometimes scarcely noticeably lighter, 4 greyish-brown as in 5, but indefinitely paler basally, and 3 lighter—though not markedly so—than 4, and indefinitely paler in basal half. In fact the coloration of the antenna lacks definition, and joints 3–8 often appear to be of a uniform coloration until subjected to a high power. Antennal joints 3 and 4 subequal in length, and the longest bristle on 3 only 27–30 μ in length, as compared with 40 μ in *F. pallida*, and neither so strong or so dark as in that species. Apical abdominal bristles not quite so long as in *pallida*, c. 125–135 compared with 140–150 μ. As in *pallida* the antero-angular pronotal bristle is markedly longer than the antero-marginal and is approximately subequal with the inner postero-angular. The fore-wing is furnished with fewer vein setæ than in *pallida*, the costa, the upper vein, and the lower vein having 14–16, 12–14, and 9–10 respectively.

Length (and breadth) of head c. 100 (148) and length of interocellars c. 54 μ; lengths of antero-angular, antero-marginal, and inner and outer postero-angular pronotal bristles respectively 72, c. 50, 72, and c. 60 μ; median pair of posterior margin 38–42 μ, with a pair of weak micro-setæ situated between them and two pairs between the inner postero-angulars and the median bristles. Lengths (and breadths) of anterior and posterior tibiæ 122 (38) and c. 170 (35) μ respectively.

Relative lengths (and breadths) of antennal segments 2–8: 35 (26), 46 (21), 46 (20), 40 (17·5), 50 (19), 10, 16 μ.

Hab. FRANCE, Charante Inférieure : St. Palais-sur-Mer, ♀♀ only, numerous on *Ononis repens*, 1. vii. 14 (*Vuillet*).

Frankliniella pallida Uz.

Hab. FRANCE, Gers: Ornézan, both sexes on *Trifolium pratense*, 19. viii. 13, and ♀♀ on *Dipsacus silvestris*, 18. viii. 13, in both cases accompanied by *F. intonsa* (Tryb.); Seine et Oise, Fontainebleau, ♀♀ on *Thymus serpyllum*, 15. vi. 13 (*Vuillet*).

Bregmatothrips iridis Wats.

Hab. FRANCE, Vilmorin, both sexes and pupæ on *Iris*, 5. vii. 13 (*Verrière*).

Physothrips pallidivestis Pr.

I have compared the French specimens recorded below with examples of *pallidivestis* kindly presented me by Priesner (from Palestine, on *Cichorium*); it is allied to *friçi* Uz.

Hab. FRANCE, Gers: Ornézan, both sexes common on *Cichorium intybus*, *Leontodon proteiformis*, and *Hieracium pilosella*, viii. 13 (*Vuillet*).

Physothrips dianthi Pr.

Hab. FRANCE, Morbihan: Kerhostin, 19. vi. 13 (*Mme. Herter*).

Thrips klapaleki Uz.

Hab. FRANCE, Oise: Bresle, near Beauvais, 1 ♀ and numerous larvæ on orchids, 1908; Gers: Ornézan, 1 ♀ and larvæ on *Spiranthes autumnalis*, 11. ix. 13 (*Vuillet*).

Thrips tenuisetosus Knechtel.

Described by Knechtel from Bessarabia, and no doubt confused with *T. angusticeps* Uz. The following records are of the brachypterous form only.

Hab. FRANCE, Montargis, ♀♀♂, on "Salade," and ♀♀ on *Taraxacum dens-leonis*, 25–26. iv. 14; Le Chesnoy (Loiret), ♀♀ only on *Senecio vulgaris* and *Lamium purpureum*, iv. 13 (*Gaumont*); Poitiers (Vienne), ♀♀ on *Bellis perennis*, 8. v. 13 (*Vuillet*).

Thrips euphorbiicola Bagn.

Hab. FRANCE, Alpes-Maritimes: Menton, 1 ♀ on *Euphorbia characias*, 28. ii. 13 (*Vuillet*).

Thrips minutissimus L.

Hab. FRANCE, Fontainebleau, both sexes in numbers on *Betula alba*, 12. iv. 14 (*Vuillet*).

Thrips difficilis Pr.

Hab. FRANCE, Jura: Lemny, 3 ♀♀ on *Salix*, 13. iv. 14 (*Vuillet*).

Suborder TUBULIFERA.

Megathrips bonnannii Uz.

FRANCE, 1 ♀ amongst grass, in the forest of Fontainebleau, 3. v. 14 (*Vuillet*).

Liothrips hradacensis Uz.

FRANCE, three ♀♀, 1 on *Quercus robus*, Chantilly, 31. v. 14 (*Vuillet*).

Treherniella stoechas Bagn.

FRANCE, Gers : Ornézan, larvæ on *Helichrysum stoechas*, 7. viii. 13 and 6. ix. 13 (*Vuillet*).

Cephalothrips monilicornis Reut.

FRANCE, Charante Inférieure, 1 ♀ and 1 ♂, St. Palais-sur-Mer, on grasses, 30. vi. 14 (*Vuillet*).

Pœcilothrips harrisoni (Bagn.).

The following is only the second known example of this fine species.

FRANCE, Charante-Inférieure : St. Palais-sur-Mer, 1 ♀ on *Pinus maritima*, 1. vii. 14 (*Vuillet*).

Phlœothrips gallicus, sp. n.

In its less strongly coriaceous head and its short strongly transverse pronotum and short postero-angular pronotal bristles this species more closely approaches *Phlœothrips brevicollis* Bagn. than either *P. coriaceus* or *immanis* Bagn. In *P. brevicollis*, however, the antennal joints 3 and 4 are approximately subequal in length.

♀.—Length 2·8 mm. ; breadth of pterothorax 0·55 mm.

Colour grey-brown to brown, much as in *coriaceus* ; all tarsi yellow, fore-tibiæ yellow, only lightly tinged with grey, to grey-brown basally ; hind and intermediate tibiæ yellow at knees and in the distal fifth or thereabouts ; body-bristles hyaline. Antenna with joint 1 concolorous with head, 2 yellowish-brown ; 3 yellow, lightly tinged with brown in the distal 0·4–0·45 ; 4 light brown, with basal 0·3 yellow ; 5 grey-brown, with basal 0·2 or thereabouts yellowish, and 6–8 a shade darker than 5, with base of 6 pale.

Wings unfortunately folded down the back, and therefore not available for description.

Head not much longer than broad, cheeks with three marked spinigerous tubercles—the lowermost set just below middle; mouth-cone conical, nearly attaining the base of prosternum; postoculars and pronotal spines straight, short and knobbed; pronotum strongly transverse, more than twice as broad as long, and two-thirds the length of the head, with antero-angular setæ apparently vestigial. Fore-coxa with at least two short sharp spines basally in addition to the fore-coxal bristle.

Fore-femur not strongly incrassate; fore-tarsus armed with a short sharp tooth, the long lower margin of which is broadly angulate near middle. Tube nearly as long as the head, 3·4 times as long as broad at base and with apex not noticeably constricted.

Measurements in microns:—

Length (and breadth) of head and pronotum 324 (304) and 216 (440); length (and breadths at base and apex) of tube 310, (91, 46); dorsal length of eye c. 108; length of postoculars, fore-coxal and postero-angular pronotal setæ 54–57, 50–56, and 68–70 respectively. Longest pair of abdominal bristles on segment 9 pointed, c. 150, and outer knobbed pair, c. 122; postero-angular knobbed bristle on 7 and 8, 122 and 111 long respectively. Length of terminal hairs (which are fumate basally) c. 148, or less than half the length of the tube.

Antenna much as in *coriaceus*, relative lengths (and breadths) of joints 2–8 approximately 76 (38), 124 (45), 97 (44), 92 (38), 78 (33), 65 (31), and 49 (19).

Hab. FRANCE, Seine et Marne: Fontainebleau, 1 ♀ on grasses, 20. v. 14 (*Vuillet*).

Genus HAPLIOTHRIPS, nov.

As in *Haplothrips* of the *subtilissimus*-group, *but having the head strongly swollen both dorsally and laterally*. Mouth-cone rounded; wings narrowed in middle, with somewhat sparse fringe (the cilia of which are widely separated), and fore-wing with a short series of duplicated cilia. Head, pronotal, and abdominal bristles well-developed and conspicuous; tube much shorter than the head, stout.

Type. *Hapliothrips globiceps*, sp. n.

The species is not unlike a small short-headed *Liothrips* on account of its type of coloration, and in the form of the head is reminiscent of *Liothrips amabilis* Bagn. The genus bears the same relation to *Haplothrips* as does *Phlœobiothrips* Hd. to *Phlœothrips.*

Hapliothrips globiceps, sp. n.

♀.—Length c. 1·4 mm.; breadth of pterothorax 0·29 mm.

As described for the genus.

Colour brown, all tibiæ and tarsi light lemon-yellow; antennæ except for basal joint also lemon-yellow, joint 2 shaded lightly with brown basally, joint 7 lightly shaded with grey and paler basally than distally, joint 8 less lightly shaded with grey. Wings practically clear. Body-bristles fumate.

Head nearly as broad as long, the eyes occupying c. 0·35 the dorsal length of the head; postoculars well developed, c. 42 μ in length.

Antennæ much as in *Haplothrips subtilissimus*-group, joint 1 short, 3 obconical, and 4 large, noticeably broader than either 3 or 5; joint 8 small and somewhat closely united with 7; the inner margin of 3 slightly rounded, not quite so straight as the outer, apparently with only one slender trichome at apex without; 4 with four sense-cones.

Pronotum transverse, about 0·7 the length of head, all bristles stoutish, prominent, and pointed, the postero-angular c. 55 μ in length; fore-tarsus apparently unarmed, but, unfortunately, tucked under head and difficult to describe.

Tube short; unfortunately set at an angle and partially obscured by fœcal matter, and difficult accurately to measure or describe; terminal hairs about as long as the tube.

Measurements in microns :—

Length of head (and breadth across eyes and across middle) 175 (150, 170); length (and breadth) of pronotum c. 128 (c. 222); length (and breadth at base and at apex) of tube 95 (58, 35); breadth of pterothorax 295, and of second abdominal segment 310. Longest bristles on abdominal segments 7, 8, and 9, 65, 76, and, 72, and length of terminal hairs c. 110. Lengths (and breadths) of tibiæ i. 146 (37), ii. 144 (35), and iii. 175 (35). Relative lengths of antennal joints 2–8, 44–46 (28), 49–51 (24·5), 54 (31), 46–94 (25), 42 (24·5), 37 (21), 22 (12).

Hab. SMYRNA, 1 ♀ on *Vitis vinifera*, 25. v. 13 (*M. Sureya*).

Haplothrips distinguendus Uz.

Hab. FRANCE, Aisne : Villers-Cotterets, 3 ♀♀ on *Cirsium palustre*, and 1 ♀ (with *Stenothrips*) on *Centaurea jacea*, 22. vi. 13 ; Charante-Inférieure : 1 ♀ on *Salvia pratensis*, St. Palais-sur-Mer, 28. vi. 14, and ♀ and ♂ on *Centaurea scabiosa*, Merchers, 15. vii. 14 ; Gers : Ornézan, 1 ♂ on *Lappa communis*, 17. viii. 13 (*Vuillet*).

Haplothrips crassus Karny.

This species is extraordinarily like *H. distinguendus* but for its short stout tube. The following are measurements of a ♀ from *Scabiosa columbaria* :—Length (and breadth) of head and pronotum 210 (208) and 175 (310) μ respectively ; length (and breadth at base and at apex) of tube 140 (60, 36) ; length of postoculars and postero-angular pronotal bristles (which are fumate basally and colourless distally) 72 and 55 respectively ; length of longest abdominal bristles on segments 7, 8, and 9, 125, 115, and 125, and length of terminal hairs c. 142 μ. Relative lengths (and breadths) of antennal joints 3–8 approximately 57 (32·5), 59 (39), 54 (30), 51 (25), 48 (21), 36 (13·5) μ.

Hab. FRANCE, Gers : Ornézan ; ♀♀ only on flowers of *Scabiosa columbaria*, 4. viii. and 19. viii. 13 (*Vuillet*). The same species is represented on two slides labelled " Composées et Dipsacées," Bar-le-Duc Vieux, 19. viii. 22.

Haplothrips eryngii, sp. n.

This species falls in the *leucanthemi* section, and can only be readily separated from *niger* (Osb.) by the strongly asymmetrical form of the third antennal joint. *H. niger* affects leguminous plants, more especially, in my experience, *Lotus* and *Anthyllis*.

♀.—Size, form, and colour as in *H. niger*. Third antennal joint greyish-yellow, shaded with brown distally, 4 brown, but not so dark as the following joints and yellowish basally, extreme base of 5 inclined to be pale. Wings apparently very slightly grey-tinged, fore-wings with five to eight duplicated cilia.

Head slightly longer than broad, of normal form, the eyes dorsally occupying about 0·4 the total length of head. Antennal joint 3 of distinctive form, strongly asymmetrical, outer margin almost straight before roundly swelling in the distal half, giving the appearance of being slightly emarginate, inner margin more or less strongly arcuate; furnished with two stoutish sense-cones; 4 slightly longer and broader than 3.

Body-bristles pale, postoculars and pronotal setæ vestigial, excepting the postero-angular pronotal pair which are 30–35 μ in length.

Tube 0·7–0·75 the length of the head.

Measurements of the type in microns:—

Length (and breadth) of head 175 (168), of pronotum 125 (245); length (and breadth at base and at apex) of tube 122 (50, 30). Length of longest bristles on abdominal segments 7, 8, and 9, 66, 66, and c. 75 respectively, and length of the terminal hairs 95–100.

Relative lengths and breadths of antennal joints 3–8 approximately: 42 (26), 45 (30), 43 (c. 27), 38 (22), 40 (18·5), 27 (10) μ.

Hab. France, Gers: Ornézan, 17. viii. to 11. ix. 13, ♀♀ plentiful on *Eryngium campestre* (*Al. Vuillet*); Charante-Inférieure: Vaux-sur-Mer, 6. vii. 14, and St. Palais-sur-Mer, 13. vii. 14, plentiful on *Eryngium maritimum*; several ♀♀ on *Scabiosa maritima*, Royau, 2. 7. 14 (coll. Vuillet).

The following are further isolated records:—Gers: Ornézan, 1 ♀ on *Lotus corniculatus*, 30. vii. 13 (*Al. Vuillet*), 2 ♀♀ on *Trifolium pratense*, 19. viii. 13; 1 ♀ on *Daucus carota*, 30. vii. 13, and 1 ♀ on *Plantago lanceolata*, 19. viii. 13. Charante-Inférieure, St. Palais-sur-Mer, 1 ♀ on *Armeria plantaginea*, 3. vii. 14, and another 19. vii. 14; Mornac, 1 ♀ on *Chrysanthemum inodorum*, 21. vii. 14. Pyrénées: Cauterets, 1 ♀ on *Ononis natrix*, 25. vi. 13 (*Marg. Vuillet*).

I have seen the red larvæ of this species on *Eryngium maritimum* at Hyères Plage (Var) and a *Haplothrips* collected by my friend Prof. J. W. Heslop Harrison, F.R.S., in the Eastern Pyrénées on *E. campestre* (the tube containing which was unfortunately destroyed) would doubtlessly be referable to the same species. I possess a single ♀ found in the Eastern Pyrénées at Canet le Plage, near Perpignan, on *Lotus* with *Haplothrips niger*, viii. 26.

Haplothrips niger (Osb.).

Hab. FRANCE, Jura : Lemny, 1 ♀ on *Anthyllis vulneraria* with *Odontothrips anthyllidis*, 22. v. 13 (*A. Paillot*).

Haplothrips nigricans, sp. n.

This species closely resembles *H. niger* (Osb.) and *H. eryngii* mihi, but is readily distinguished by its entirely dark fore-legs, the form of the third antennal joint, and the exceptionally short and weak bristles of the ninth abdominal segment, which are only about one-third the length of the tube. The wings of the unique example are unfortunately folded down the back, and therefore not fully available for description ; the cilia are apparently simple (*i. e.*, non-setulose), and the duplicate cilia appear to number eight.

♀.—Length 1·75 mm.; breadth of pterothorax 0·32 mm. Dark, entirely brown to deep blackish-brown except the third antennal joint, which is ash-coloured basally and darker in the distal half, though not so dark as the rest of the antennæ. Bristles of the head and pronotum apparently vestigial ; lateral abdominal bristles moderately long, pale, excepting those of segment 9, which are very short and weak.

Head scarcely longer than broad, much as in *distinguendus*, the eyes dorsally occupying about 0·4 the total length of the head. Antennal joint 3 obconical, much as in *leucanthemi*, 4 subequal in length with 3, but broader. Tube about 2·3 as long as broad at base and nearly 0·75 the length of the head.

Measurements in microns :—

Length (and breadth) of head 178 (168), of pronotum 140 (250) ; length (and breadth at base and at apex) of tube 132 (57, 34). Length of longest bristles on abdominal segments 7, 8, and 9, 75, 70, and 45 respectively, and length of terminal hairs c. 105.

Relative lengths and breadths of antennal joints 3–8 approximately 57 (27), 57 (32), 50 (25), 46 (21·5), 43 (21), 30 (16).

Hab. FRANCE, Côte d'Or: 1 ♀ (most likely casual) on *Sambucus ebulus*, Beaune, 1. vii. 13 (*A. Paillet*).

Haplothrips leucanthemi (Schr.).

Hab. FRANCE, Aisne: Dercy, 15. vi. 13, 1 ♂ and several ♀♀, and Nogent-sur-Marne, ♀♀ only, 3. vi. 13; Manche: Ducey, 1 ♀, 22. vi. 13, in each case on *Leucanthemum vulgare*. Charante Inférieure: Vaux-sur-Mer, 5. vii. 14, on *Chrysanthemum leucanthemum* (*Vuillet*).

LI.—*Otoliths of Fishes from the Lower Tertiary Formations of Southern England.—*V. *Anacanthini, Heterosomata, Ostariophysi*. By G. ALLAN FROST, F.L.S., F.G.S.

[Plate XIV.]

Order ANACANTHINI.

Otolithus (*Gadus*) *subnotus*, sp. n.
(Pl. XIV. fig. 1.)

Shape ovate, biconvex, outer side umbonated; dorsal rim concave, highest anteriorly, passing into the pointed posterior rim; ventral rim curved; anterior rim rounded. Sulcus enclosed, angle on lower margin; ostium shorter than cauda, with double lines to lower margin; cauda curved, with rounded end.

Resembles that of the Recent species *Gadus luscus* (Frost, Ann. & Mag. Nat. Hist. 1926, xviii. p. 487, pl. xxii. figs. 14–15).

One specimen, 4 × 2 mm. Lower Eocene, London Clay, Worcester Park, Surrey.

Otolithus (*Gadus*) *eocenicus* Frost.
(Pl. XIV. fig. 2.)

'The Vertebrate Faunas of the English Eocene' (E. I. White), 1931, p. 106, pl. i. fig. 15.

Resembles *O.* (*Gadus*) *subnotus* generally, but differs in the square anterior part and in the spear-shaped cauda, which is similar to that of the Recent species *Gadus œglefinus* (Frost, *t. c.* p. 485, pl. xxii. fig. 8).

Eighty specimens, coll. Brit Mus. Nat. Hist., holotype

P 15296. Lower Eocene, Blackheath Beds, Abbey Wood, Kent.

Otolithus (*Gadus*) *meyeri* Koken.

E. Koken, 1888, *O.* (*Gadidarum*) *meyeri* *.
R. Schubert, 1915 (*O.* (*Ophidiidarum*) *dimidiatus* †.

Described by Koken from the Lower Tertiaries of North America, and by Schubert from the Upper Eocene of Barton.

Sulcus long, broad, enclosed, divided by a vertical groove; ostium and cauda equal; end of cauda rounded.

Numerous specimens up to 5½ × 3 mm. Upper Eocene, Barton, Hampshire.

Otolithus (*Gadus*) *rectus*, sp. n.

(Pl. XIV. fig. 4.)

Shape ovate, biconvex, outer side smooth; resembles in shape *O.* (*Gadus*) *subnotus*, but differs in the long, straight, undivided sulcus, which is occupied by a long colliculum and has the lower margins sloping inwards.

Three specimens, 4×2 mm. Upper Eocene, Barton, Hampshire.

Otolithus (*Macrurus*) *minimus*, sp. n.

(Pl. XIV. fig. 5.)

Shape high, roughly hexagonal; dorsal rim high, serrated; ventral rim curved; posterior rim vertical; anterior rim with upper part concave, lower part prominent and rounded. Sulcus enclosed, two or three angles on lower margin, resembling that of the Recent species *Macrurus cœlorhyncus* (Frost, *t. c.* p. 483, pl. xxii. fig. 3). These minute otoliths occur in great numbers in the Barton beds, and were referred to the family Gobiidæ by the late Col. C. E. Sheppherd and recorded by me as such in "A Comparative Study of the Otoliths of the Neopterygian Fishes"; a further comparison of the sulcus, however, shows this to be incorrect and that they are the otoliths of immature Macrurid fishes.

Numerous specimens, 1½ × 1½ mm. Upper Eocene, Barton, Hampshire.

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* E. Koken, "Neue Untersuchungen an tertiären Fisch-otolithen," Zeitschr. d. deut. geol. Gesell. xl. p. 274, Taf. xvii. (Berlin, 1888).

† R. Schubert, "Obereocäne Otolithen vom Barton Cliff bei Christchurch," Jahrb. der k.k. Geol. Reichsanst. lxv. p. 285, Taf. vii. fig. 39 (Wien, 1915).

Otolithus (Merluccius) shepherdi Schubert.

(Pl. XIV. figs. 6–7.)

R. Schubert, 1915, *t. c.* p. 282, Taf. vii. figs. 25–26.

Resembles the otoliths of the Recent species *Merluccius vulgaris* (Frost, *t. c.* p. 484, pl. xxii. fig. 6). Described by Schubert from the Upper Eocene of Barton.

Numerous specimens up to 13 × 5 mm. Upper Eocene of Barton, Hampshire, and Lower Eocene, London Clay, Worcester Park, Surrey.

Otolithus (Phycis) gracilis, sp. n.

(Pl. XIV. fig. 9.)

Shape lanceolate, outer side flat, inner side convex; dorsal rim highest posteriorly; ventral rim curved; posterior and anterior rims pointed. Sulcus enclosed, curved; ostium long and even; cauda small, circular.

Resembles that of the Recent species *Phycis blennioides* (Frost, *t. c.* p. 487, pl. xxii. fig. 16); but differs in the height of the dorsal rim and in the shorter sulcus.

One specimen, 5½ × 2 mm. Upper Eocene, Highcliffe, Hampshire.

Order HETEROSOMATA *.

Otolithus (Bothus) contortus, sp. n.

(Pl. XIV. fig. 8.)

Shape elongate, irregular, biconvex; dorsal rim curved, regular, passing into the pointed posterior rim; ventral rim deepest anteriorly; anterior rim with rounded projection on lower part. Sulcus narrow, horizontal, medianly compressed; ostium and cauda wedge-shape with the narrow ends opposed.

Resembles that of the Recent species *Bothus podas*, but differs in the irregular ventral rim.

One specimen, 3½ × 1½ mm. Upper Eocene, Barton, Hampshire.

Otolithus (Pleuronectidarum) tenuis, sp. n.

(Pl. XIV. fig. 10.)

Shape lanceolate, biconvex, widest anteriorly; dorsal and ventral rims curved; posterior rim narrow and extended; anterior rim pointed, upper part concave.

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* G. Allan Frost, ser. 10, vol. v. p. 231, pl. ix. (1930).

Sulcus enclosed, divided; ostium ovate, cauda minute and circular, the ostium resembling those of the Pleuronectidæ and the cauda those of the Soleidæ.

One specimen, 4½ × 2 mm. Lower Eocene, London Clay, Isle of Sheppey.

Otolithus (*Solea*) *bartonensis*, sp. n.
(Pl. XIV. fig. 11.)

Shape circular, outer side flat, inner side convex; dorsal rim domed, forming angle with the slightly concave posterior rim; ventral rim semicircular, passing into the rounded anterior rim.

Sulcus broad, divided, with slight upper angle, opens on the anterior rim. Ostium wide, lower margin longer than the upper; cauda with rounded end. In other examples the sulcus is narrow and undivided.

Resembles in shape circular examples of the Recent species *Solea variegata*, but differs in the width of the sulcus and in the open ostium.

Five specimens, 1 × 1 mm. to 2 × 2 mm. Upper Eocene, Barton, Hampshire.

Order OSTARIOPHYSI*.

Suborder SILUROIDEA.

E. Koken, 1884, *Otolithus* (incertæ sedis) *crassus* †.

Shape semi-globular, outer side smooth, inner side with central umbo, concentric lines, and radial furrows to posterior and ventral rims; upper part smooth with broad striations; anterior rim with low blunt projection. Described by Koken from the Oligocene of Headon Hill, Isle of Wight.

Resembles generally that of the Recent species *Felichthys marinus* (Frost, *loc. cit.* 1925, xvi. p. 435, pl. xxii. figs. 6–7).

Six specimens up to 11 × 9 mm. Upper Eocene, Barton, Hampshire.

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* The Ostariophysi have been taken last, as the only order in which the lapillus is the otolith described.

† E. Koken, "Ueber Fisch-Otolithen insbesondere über diejenigen der nord-deutschen oligocän-ablagerungen," Zeit. d. deut. geol. Ges. xxxvi. p. 500 (Berlin, 1884).

Otolithus (*Arius*) *anglicus* Bassoli *.
(Pl. XIV. fig. 13.)

Shape conchoidal, flat, slightly convex; faint concentric rings on inner side with delicate striations between; a furrow runs from the centre to the anterior part of the ventral rim.

Described by Bassoli from Brockenhurst, Hampshire. It differs from *O.* (*Arius*) *crassus* in the flatter shape and in the prominent rounded anterior process.

Three specimens up to 6×5 mm. Upper Eocene, Barton, Hampshire.

Otolithus (*Arius*) *planus*, sp. n.
(Pl. XIV. fig. 14.)

Shape elliptical, biconvex, rather flat; outer side smooth; inner side smooth, with domed centre surrounded by concentric lines; a ridge extends from the centre to the anterior point, above which a triangular depression is present; dorsal rim curved passing into the rounded posterior rim; ventral rim curved, posterior part sunken; anterior point rounded.

Resembles *O.* (*Arius*) *germanicus* described by Koken from the Lower Oligocene of Lattorf (Koken, 1891, *loc. cit.* xliii. p. 77, pl. vi. fig. 8), but differs in the greater length, in the smooth centre of the inner side, and in the shape of the anterior point.

Two specimens, 11×8 mm. Upper Eocene, Barton, Hampshire.

Otolithus (*Arius*) *æquus*, sp. n.
(Pl. XIV. fig. 15.)

Shape pip-like, biconvex; outer side smooth; inner side centre raised, with fine concentric lines near periphery; dorsal rim high, rounded, passing into the rounded posterior rim; ventral rim flattened, with anterior angle.

Resembles *O.* (*Arius*) *parvus* described by Schubert from Barton (*t. c.* p. 287, Taf. vii. fig. 24), but differs in the raised centre of the inner side, in the narrow dorsal rim, and in the flattened ventral rim.

One specimen, 8×6½ mm. Upper Eocene, Barton, Hampshire.

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* G. G. Bassoli, "Otoliti fossili di Pesci," Atti della Societa dei Naturalisti e Matematici di Modena (1909).

EXPLANATION OF PLATE XIV.

Fig. 1. *Otolithus* (*Gadus*) *subnotus*, sp. n.
Fig. 2. —— (——) *eocenicus*, sp. n.
Fig. 3. —— (——) *meyeri* Koken.
Fig. 4. —— (——) *rectus*, sp. n.
Fig. 5. —— (*Macrurus*) *minimus*, sp. n.
Figs. 6, 7. —— (*Merluccius*) *shepherdi* Schubert.
Fig. 8. —— (*Bothus*) *contortus*, sp. n.
Fig. 9. —— (*Phycis*) *gracilis*, sp. n.
Fig. 10. —— (*Pleuronectidarum*) *tenuis*, sp. n.
Fig. 11. —— (*Solea*) *bartonensis*, sp. n.
Fig. 12. —— (*Arius*) *crassus* Koken.
Fig. 13. —— (——) *anglicus* Bassoli.
Fig. 14. —— (——) *planus*, sp. n.
Fig. 15. —— (——) *æquus*, sp. n.

LII.—*A Revision of the Trilobite Genera* Deiphon *and* Onycopyge. By W. F. Whittard, Ph.D., D.I.C., A.R.C.S.

[Plates XV. & XVI.]

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III.	Mode of Life	526
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V.	Literature	529

The Upper Valentian sandstones of the Bog Mine Outliers, situated in the Shelve country of Shropshire, have yielded a large shelly fauna, which includes several incomplete cranidia of *Deiphon*. While looking for a species in which to place the material, it became evident that although the structure of *Deiphon forbesi* is moderately well known, yet the descriptions were inadequate. Comparison with other species indicated that a great deal of the recorded fossils were insufficiently described, while the structure of *Onycopyge* suggested the lines along which the extremely specialized type of *Deiphon* exoskeleton might have developed. Apart from the general interest which attaches to such bizarre trilobites, a redescription of as many of the known specimens as could be procured for examination seemed desirable.

I. DESCRIPTIONS OF THE GENERA AND SPECIES.

TRILOBITA.

Family **Cheiruridæ** Salter, 1864.

Genus DEIPHON Barrande, 1850.

Diagnosis.—Tumid portion of glabella unsegmented, egg-shaped, spherical, or transversely ovoid; basal lateral glabellar lobes small, nodular; occipital ring short, usually forming base of "stalk" which carries glabella; fixed cheeks spinose, secondary spine on frontal border; free cheeks small, subtriangular; eyes reniform, finely facetted; facial suture short, no ventral median suture; no rostral plate; hypostoma rectangular, pear-shaped middle body, lobate anterior wings. Thorax of nine segments, spinose pleuræ, no fulcrum; facets at the side of the axis on cephalon and pygidium for the articulation with the first and ninth thoracic pleuræ respectively. Pygidium of five fused segments, shape variable, but always with two pairs of spines, the posterior being the better developed. Test ornamented by granules usually of two sizes.

Deiphon forbesi Barrande. (Pl. XV. figs. 1–3.)

1850. *Deiphon forbesi* Barrande, p. 6 & text-fig.
1852. *Deiphon forbesi* Barrande, pp. 814 & 931, pl. ii. B, fig. 4, and pl. xxxix. figs. 50–55.
1872. *Deiphon forbesi* Barrande, p. 115, pl. ii. figs. 19–20.
1898. *Deiphon forbesi* Reed, p. 211.
1925. *Deiphon forbesi* Warburg, p. 395.

Barrande's classical descriptions of *Deiphon forbesi* were founded upon excellently preserved specimens stated to come from the Eβ (=Ee$_2$) beds of Bohemia (but see p. 529), and the following redescription is based upon several of his metatypes. Dr. J. Koliha has informed me that only one complete individual is known from the Bohemian sediments, and this is the specimen figured by Barrande (1872, pl. ii. fig. 19).

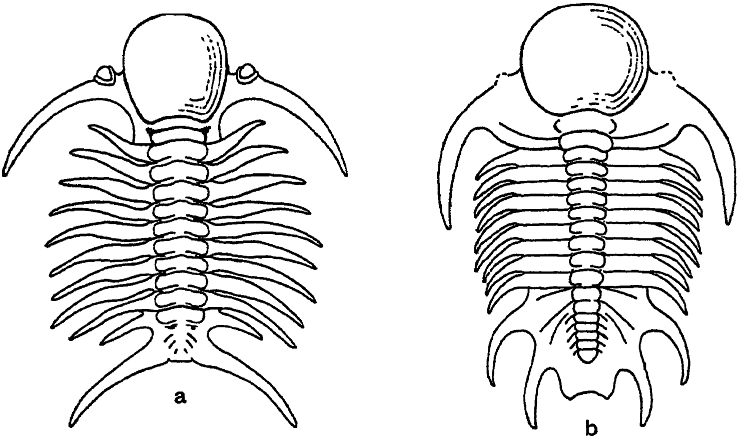
Description.—Cephalon is inflated, with laterally directed spinose fixed cheeks; ratio of cephalon length to breadth varies from 2 : 5 to 1 : 3.

Glabella consists of a tumid, subspherical mass, and a pair of well-defined basal lateral glabellar lobes. In some individuals the length of the swollen glabellar mass is the same as the breadth, as in the case of the largest known specimen, which measures 8 mm. in both directions; in others, the length is usually less than the breadth. The glabella is markedly convex, and descends anteriorly to the pre-glabellar furrow, which it slightly overhangs, and posteriorly to the occipital furrow; laterally, it plunges downwards on either side to the axial furrow. The basal lateral glabellar lobes are small and delineated by deep basal lateral and occipital furrows, which coalesce medially. The occipital ring is transversely arched and forms a stalk on which is carried the inflated portion of the glabella. The axial furrow is shallow on either side of the occipital ring, deep at the occipital furrow, and rises to delimit the side of the lateral glabellar lobe; thence it deepens at the base of the tumid glabella, ascends sharply to the place of origin of the fixed cheeks, and descends steeply to be continued round the glabella front as the pre-glabellar furrow. This latter is gently arched medially and lies above the anterior branch of the facial suture. The anterior margin furrow is undeveloped. On either side of the cranidium at the level of the occipital ring, external to the axial furrow, there is an almost flat area which, when traced back to the posterior margin of the cephalon, is seen to carry a small articular facet (Pl. XV. fig. 1). This surface is connected with the inner part of the front margin of the first thoracic pleura. Such a development would obviously secure closer union between the thorax and cephalon in an animal in which the exoskeleton is so reduced, and is additional to any articulation made by the axial ring with the occipital ring; a similar facet is better shown in a variety of the genotype on Pl. XVI. fig. 2. Similarly, the pygidium carries a pair of spinose facets in front of the other two pairs of spines, and their function appears to have been like that already described for the cephalon (Pl. XV. fig. 3).

Fixed Cheeks are largest internally, and form spine-like processes which curve backwards; the posterior margin commences approximately 1 mm. to the side of the axial furrow bounding the occipital ring, sweeps forwards for a short distance, and thence curves outwards and finally backwards. The front margin of the fixed cheeks is directed backwards for the major portion of its course, being slightly upraised in the region of the eye. The curvature of the cheek tends to be more pronounced in younger than in more mature individuals. There is invariably a small secondary spine situated just external to the eyes which projects forwards and downwards from the front border of the cheek.

Free Cheeks are diminutive, a condition which may be directly correlated with the reduction of the fixed cheeks to mere spinose processes (Pl. XV. fig. 2). The posterior branch of the facial suture cuts the anterior margin about 1 mm. from the inner side of the secondary spine, and trends obliquely backwards and inwards to cut the protuberant inferior eyelid midway along its course. The anterior branch originates at the front of the palpebral lobe, swings forwards and inwards, and occupies a position immediately under and parallel to the pre-glabellar furrow. There is no evidence of a ventral median suture between the free cheeks; as in some other trilobites, *Deiphon* is characterized by the fact that the free cheeks are fused into a single unit. The inferior margin of the combined free cheeks shows a semicircular embayment for the reception of the front of the hypostoma. The eyes are reniform, more rounded anteriorly than posteriorly, and

Text-fig. 1.



(*a*) Reconstruction of *Deiphon forbesi* (modified from Barrande). × 2.
(*b*) Reconstruction of *Onycopyge liversidgei*. × 1·4 approx.

project well above the level of the fixed cheek, opposite the mid-point of the tumid glabellar mass. Barrande has recorded that the eye is made up of about 200 facets, and this number agrees with my own determination. The palpebral lobe is clearly delineated, but its relation to the facial suture is unusual. In most trilobites the palpebral lobe invades the inner margin of the eye, the facial suture extending from the anterior and posterior extremities; in *Deiphon forbesi*, while the anterior branch of the facial suture occupies its usual position, the posterior branch originates on the outer eye margin; it has thus migrated from a more normal posterior position to a lateral and external position. A portion of the inferior eyelid is thus carried on the fixed cheek, whereas it is usually confined to the free cheek. The palpebral lobe and inferior eyelid form a pronounced rim surrounding the eye (Pl. XV. fig. 1).

The hypostoma is unknown.

The thorax consists of nine segments, each pair of pleuræ being spinose. The axial rings are curved simply, carrying articulatory half-ring and furrow. The first segment is short with the pleuræ directed forwards; successive pleuræ first extend outwards and later are directed backwards, at the same time gradually increasing in size; the ninth pair of pleuræ is slightly shorter than the eighth. Barrande attached much importance to the character of the thoracic pleuræ in trilobites generally, and in *Deiphon forbesi* he has recorded that there is "un sillon médian, qui détermine deux bandes égales" (1872, p. 115).

The pygidium is characterized by two pairs of pleural spines, of which the posterior pair is always the better developed, and a pair of small antero-lateral facetted spines for connection to the pleuræ of the ninth thoracic segment (Pl. XV. fig. 3). Whereas Barrande contended that there were nine thoracic segments, Salter maintained that there were ten in the adults of the British specimens, herein referred to *Deiphon forbesi barrandei*, the tenth having been liberated from the front of the pygidium during development (Salter, 1865, p. 89); in such pygidia only the posterior pair of spines was present. Having examined nearly all Salter's material, and much more in addition, it is evident that Barrande's opinion was correct. Five segments are present in the pygidium, the anterior one carrying an articulatory half-ring and spinose pleuræ. The rib furrows (=furrows between the pleuræ) are almost obsolete; those between the first and second segments are deep laterally, while the remaining three pairs are seen as grooves situated in a depressed oval area, surrounded by a raised border which grades backwards into the larger pair of pleural spines. Even in the smallest specimens the posterior spines diverge at a large angle varying from 110° to 150°.

A line reconstruction of *Deiphon forbesi* is given in text-fig 1, *a*, and this has been modified from Barrande (1872, pl. ii. fig. 19).

Material and Localities.—Sixteen metatypes have been examined and were obtained from Listice, Lodenitz, and Ohrada, Bohemia.

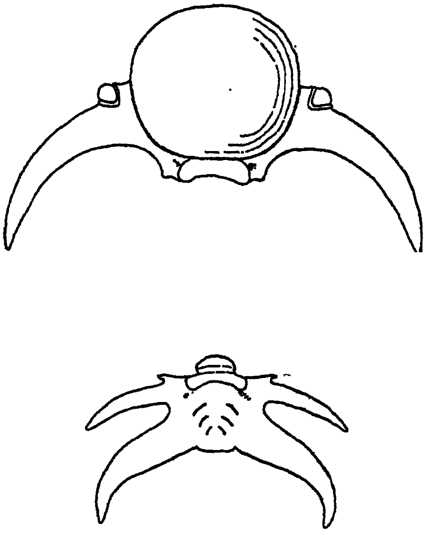
Geological Horizons.—Barrande records the species only from his Ee_2 beds (=$E\beta$ of later workers); these are placed by Heritsch equivalent to the two topmost zones of the Lower Ludlow of Britain (1928, p. 339). Perner and Kodym, however, think that Barrande confused the horizon of this fossil, and that it actually occurs in the E_1 beds in the Zone of *Cyrtograptus murchisoni*, and only doubtfully record the form from the E_2 beds (1922, p. 61).

Deiphon forbesi var. *globifrons* (Angelin).
(Pl. XV. figs. 4–13.)

1854. *Deiphon globifrons* Angelin, p. 66, pl. xxxiv. fig. 7.
1885. *Deiphon forbesi* Lindström, p. 51, pl. xiii. figs. 9–10, and pl. xv. figs. 18–20.
1907. *Deiphon forbesi* Schmidt, p. 13, pl. i. fig. 7.
1925. *Deiphon forbesi* Warburg, p. 396.

Description.—The proportions of the cephalon show a general relationship of length to breadth of 2 : 5. The largest measurements obtained for the tumid glabellar mass are 14 mm. long by 14·5 mm. broad, while the smallest specimen examined is 3 mm. long. The glabella is more swollen than in the genotype, and overhangs more the occipital region (Pl. XV. fig. 6, *a*), but the lateral glabellar lobes and the various furrows show no appreciable differences. The ornament of the largest individuals consists of coarse granules, particularly on the posterior surface of the glabellar mass (Pl. XV. fig. 10), while younger specimens show a pattern of granules interspersed by smaller ones (Pl. XV. fig. 4). The eyes are reniform and situated opposite the mid-point of the swollen glabella. The spinose fixed cheeks are more sturdily proportioned than is usual in the genus, and at their termination they curve upwards. The course of the facial suture is clearly delimited; the anterior branch originates at the front of the inner side of the eye margin, swings inwards and downwards, and occupies a position immediately underneath the pre-glabellar furrow (Pl. XV. figs. 5 & 6, *b*); there is no median suture between the cheeks. The posterior branch cuts the front margin about 1 mm. from the inner side of the secondary spine and trends inwards and backwards to the inferior eyelid, which it cuts about one-third the distance along its length (Pl. XV. fig. 5); ventrally it swings downwards, thence inwards, and cuts the lateral hypostomal inlet (divided into an anterior notch and a posterior groove) at the edge of the posterior groove (Pl. XV. figs. 8 & 9);

Text-fig. 2.



Partial reconstruction of *Deiphon forbesi globifrons*. × 2.

thus the complete course of the facial suture is known. Both the bifid lateral inlet on the under side of the cephalon and the hypostoma are so perfectly preserved that the method of articulation can be determined. If in ecdysis the fused free cheeks were liberated first, then they would take with them the anterior notch and part of the posterior groove, and, since the hypostoma was lodged over the flange bounding the notch, it may have been shed with the free cheeks. On the other hand, during ecdysis the hypostoma may have moved back along the posterior groove, much of which is carried on the fixed cheek. The hypostoma is provided with a pair of antero-lateral wings, which fit into their respective grooves on the under side of the cephalon, and were attached almost certainly over the flange extending from the groove to the notch. The shape of the groove shows that the hypostoma was movable forwards and backwards.

The structure of the hypostoma is well shown in a specimen which was first figured by Lindström (1885, pl. xv. figs. 18–20); it is isolated from the matrix and shows both ventral and dorsal views (Pl. XV. fig. 7, *a* & *b*). The *ventral side* is characterized by a pear-shaped middle body, which tapers posteriorly, and is delineated by the anterior and postero-lateral furrows. Where these two furrows meet, another furrow (here termed the anterior wing furrow) takes its origin, and passes almost to the termination of the anterior wing. The lateral margins are disposed nearly at right angles to the posterior margin, and this gives a rectangular shape to the hypostoma. The lateral margin on either side carries a small side projection situated at about two-thirds the distance from the posterior end; the function of these projections is uncertain. The anterior border is transversely convex, but near the junction of the anterior, postero-lateral, and anterior wing furrows it swings forwards and downwards, and outlines the front of the lobate anterior wing, the posterior margin of which is formed by the continuation of the lateral border margin. The anterior wing fits into the bifid lateral inlet in the under surface of the cephalon. The anterior border carries a row of tubercles, while the middle body is granulated; the postero-lateral border is finely ornamented. The *dorsal* *side* of the hypostoma is concave in the region of the middle body, being surrounded by a wide, smooth, and transversely convex ridge, which is the complement on the dorsal side of the anterior and postero-lateral furrows of the ventral surface. The postero-lateral border in its dorsal aspect is slightly concave, except in the region of the problematical, small, side projections already noted above ; these projections are continued backwards and inwards as ridges bearing a granulated ornament, dying away just before the inner margin of the postero-lateral border is reached. This border is at a higher level than the smooth postero-lateral ridge bounding the middle body, from which it is separated by a groove which is incised horizontally ; this is continued into the anterior wings, but is not visible either as a groove or ridge on the ventral surface.

The thorax is incompletely preserved, but there are indications of nine segments with normal axial rings. The one available specimen has already been figured (Lindström, 1885, pl. xiii. fig. 9).

The pygidium is known from a small and a larger individual. The usual characters found in *Deiphon* are present. In the younger specimen the posterior spines diverge at approximately 90° and then curve inwards (Pl. XV. fig. 12), while in the more mature individual the angle is 100° (Pl. XV. fig. 11).

A composite reconstruction of the cephalon and pygidium of *Deiphon forbesi globifrons* is given in text-fig. 2, but there is insufficient data upon which to base a drawing of the thorax.

Material and Localities.—Seventy specimens including those figured by Lindström have been examined. The material was collected at several localities in Gotland including Fårö, Lilla Carlsö, Slite, Visby (Likkershamn), and Hall. One specimen referred to this variety was collected by Dr. C. Casper from a derived block at Oliva, Danzig (Pl. XV. fig. 13).

Geological Horizon.—Gotlandian Limestone.

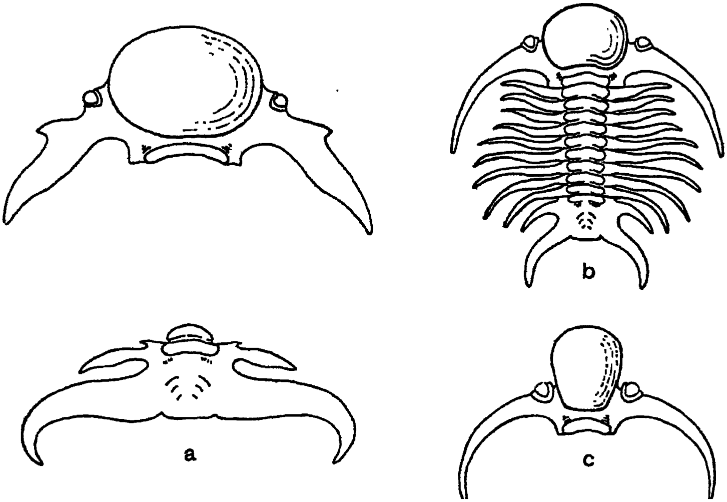
Deiphon forbesi var. *barrandei*, var. nov.
(Pl. XVI. figs. 1–4.)

1854. *Deiphon forbesi* Morris, p. 106.
1854. *Deiphon forbesi* Murchison, p. 235.
1865. *Deiphon forbesi* Salter, p. 88, pl. vii. figs. 1–12.

1865. *Deiphon forbesi* Salter & Woodward, pl. iv. fig. 54.
1877. *Deiphon forbesi* Woodward, p. 147.
1919. *Deiphon forbesi* Garwood & Goodyear, p. 19.

Description.—The cephalon shows the general characters of the genotype. The tumid glabellar mass is variable, but on the whole it exhibits a greater breadth in proportion to length than is found in any other species or variety; there are also specimens which measure equally in both directions, a character usually associated with younger individuals. The basal lateral glabellar lobes are developed, and the several furrows show no apparent differences from *Deiphon forbesi*. One striking feature is the coarseness of the granulation. The fixed cheeks changed their appearance with age, and whereas in other forms these remained comparatively regular even in the largest specimens, in *barrandei* they became gnarled and tended to develop protuberances. The free cheeks show the usual triangular outline. The eyes

Text-fig. 3.



(*a*) Partial reconstruction of a presumed adult of *Deiphon forbesi barrandei*. × 2.
(*b*) Reconstruction of a younger individual of *Deiphon forbesi barrandei*. × 2.
(*c*) Reconstruction of the cephalon of *Deiphon longifrons*. × 2.

are reniform, with apparently fewer facets than in the genotype ; in the largest individuals the eyes are separated from the glabella by a shallow groove, while in the younger forms this groove is deep (compare Pl. XVI. figs. 1 & 2). The eye level is about the mid-length of the tumid glabellar mass. The posterior branch of the facial suture cuts the inferior eyelid between one-third to one-half of its length, while the anterior branch commences well to the front of the eye margin (Pl. XVI. fig. 4). There is no median suture between the free cheeks, which are characteristically ornamented by a few pronounced tubercles.

The hypostoma is constructed on the same plan as in *globifrons*, but the middle body is more sturdily proportioned, and it carries larger tubercles than in this variety (Pl. XVI. fig. 4).

The thorax consists of nine segments ; the pleuræ are smooth and there is no fulcrum. The pleuræ of the sixth segment are almost horizontal ; those in front are shorter and directed forwards, and those behind are curved backwards. The axial ring carries an articulatory furrow anteriorly, which grades into the raised portion of the articulatory half-ring.

The pygidium shows a similar arrangement of parts as in *Deiphon forbesi*. On either side of the articulatory half-ring and in front of the smaller pair of pleural spines, there is a pair of spinose lateral processes, which abut against the back of the ninth thoracic segment. In small individuals the posterior pair of pleural spines are shorter and much thicker than in either *D. forbesi* or *D. forbesi globifrons*, and they diverge at an initial angle of about 85° (Pl. XVI. fig. 1). In the largest specimens the spines are thicker and diverge at 180°, turning round abruptly and pointing inwards at their terminations (Pl. XVI. fig. 3). There is this tendency in *globifrons* for the spines to grow horizontally, but I have examined no specimen in which the development is so pronounced as in *barrandei*.

Line reconstructions of two individuals of *Deiphon forbesi barrandei* showing different stages of growth are given in text-figs. 3, *a* & *b*.

Material and Localities.—Forty-two specimens have been examined from Dudley, from the Silurian outcrop west of the Malvern Hills, and from Old Radnor.

Geological Horizons.—Silurian: Woolhope Shales, Woolhope Limestone, Wenlock Shales, and Wenlock Limestone.

Holotype.—No. 1 (University Museum, Oxford) from the Wenlock Shales of the Malverns.

Paratypes.—No. 2 (University Museum, Oxford) from the Wenlock Shales of the Malverns, no. A 3296 (Sedgwick Museum) from the Wenlock Limestone of Dudley, and no. 38953 (B.M.N.H.) from the Wenlock Shales of Dudley.

Deiphon forbesi var. *dikella* *, var. nov.
(Pl. XVI. fig. 7.)

The only available specimen is distorted by crushing, much of the occipital region being obscured (Pl. XVI. fig. 7, *a*). As far as can be ascertained, the cephalon is similar to that of the genotype. The swollen mass of the glabella is spherical in shape and ornamented by fairly coarse-grained tubercles (Pl. XVI. fig. 7, *b*). The anterior branch of the facial suture trends inwards from near the inner side of the secondary spine on the fixed cheek, and cuts the inferior eyelid midway along its length.

The thorax shows the usual nine segments. The first is 12 mm. broad, and successive segments gradually increase, reaching a maximum breadth of 16 mm. in the sixth, the remainder being slightly less broad. The axial ring is normal, pleuræ are smooth, and there is no fulcrum. The pleuræ of the first segment are directed forwards, and progressing posteriorly each pair is arranged more towards the horizontal, a position attained in the fifth and sixth segments; thereafter the remaining pleuræ curve backwards.

The pygidium is moderately preserved and exhibits two pairs of spines, of which the posterior pair is strongly developed, diverging at an angle of 70°; the fork-like appearance of these spines suggested the varietal name (Pl. XVI. fig. 7, *b*). In no other form of *Deiphon* are the posterior spines so large when the swollen mass of the glabella measures only 8 mm. across, and neither is the angle of divergence so small as 70°.

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* δικέλλα=fork (pitchfork), referring to the posterior pair of pygidial spines.

Material and Locality.—The holotype (no. A 3507, *a* & *b*, Sedgwick Museum), in the form of an internal cast and an external mould, was collected from near the Gasworks, Haverfordwest, South Wales.

Geological Horizon.—Silurian : Gasworks Mudstones, Lower Valentian.

Deiphon forbesi cf. var. *dikella*, var. nov.
(Pl. XVI. figs. 5, 6.)

1906. *Deiphon forbesi* Reed, p. 150.
1931. *Deiphon forbesi* Reed, p. 23.
1932. *Deiphon* cf. *forbesi* Whittard, p. 880.

Pending the discovery of more perfect material from the Upper Valentian rocks of Shropshire, the specimens are referred to the Lower Valentian form here described as *Deiphon forbesi dikella*. Other material given in the synonymy is that recorded by Reed from Girvan, but the specimen is so incomplete that it calls for no further mention.

In the fossils from Shropshire the tumid portion of the glabella is usually as long as it is broad (Pl. XVI. fig. 5). The glabella, ornamented by granules visible in external mould only, overhangs the pre-glabellar furrow, which is only slightly arched medially. The basal lateral glabellar lobes are well defined in the casts because of the deeply incised occipital and basal lateral furrows. The eyes are situated on a level with the mid-length of the glabellar mass (Pl. XVI. fig. 6).

Material and Localities.—Ten incomplete cranidia have been collected from the Bog Mine Outliers, Shelve, Shropshire, one from an outcrop 1100 feet, S. 15° E. of Barytes Mill, Wagbeach, Shropshire, and one from Mulloch Hill, Girvan. The material is in the form of internal casts and external moulds.

Geological Horizons. Silurian: the sandy representatives of both the Pentamerus Beds (Wagbeach) and the Purple Shales (Bog Mine) all being of Upper Valentian age (Zone of *Monograptus turriculatus*); the Lower Valentian (Mulloch Hill Group) of Girvan.

Deiphon angelini Warburg. (Pl. XV. figs. 14, 15.)

1854. *Deiphon lævis* Angelin, p. 77, pl. xxxix. fig. 5.
1884. *Deiphon forbesi* Törnquist, p. 22, pl. i. figs. 13–14.

1907. *Deiphon punctatus* Wiman, p. 4.
1925. *Deiphon angelini* Warburg, p. 394, pl. x. figs. 40–42.
1926. *Deiphon angelini* Troedsson & Roswall, p. 444.
1927. *Deiphon angelini* Kummerow, p. 26.

The three type-specimens have been available for study, and I cannot do better than to quote from the original account (Warburg, 1925, p. 394); one of the syntypes is illustrated herein (Pl. XV. fig. 14).

"Glabella in front of basal lateral furrows swollen into a large, convex mass, sub-oval to sub-quadrilateral in outline, widest at about half-way between posterior and anterior margins. . . . Anterior two pairs of lateral glabellar furrows entirely obsolete. Neck of glabella very short, depressed, with small, sub-triangular, nodular basal lateral lobes; its middle portion smooth and groove-like, forming a direct continuation of the basal lateral glabellar furrows, which are rather wide, but not deep. Axial furrows narrow and shallow outside occipital ring and basal lateral glabellar lobes, in front of latter of moderate width and outside base of swollen portion of glabella very deep, almost straight, diverging anteriorly, then growing shallower again and curving at first slightly upwards and then steeply downwards and slightly inwards to merge into the well-marked, almost straight preglabellar furrow. Occipital furrow narrow, nearly transverse and very shallow in middle and almost confluent with depressed neck of central glabellar lobe, growing deep and curving forwards at sides. Occipital ring narrow, scarcely wider in middle than at sides, strongly arched transversally, gently rounded longitudinally. . . ."

Dr. Kummerow has recently recorded *D. angelini* from an erratic block found near Brandenburg. The specimen is a little more complete than are Warburg's types, and shows part of the spinose fixed cheek and also the root of the secondary spine. Unfortunately, the region of the free cheek is broken, but it is quite evident that the eye must have lain close alongside the glabella (Pl. XV. fig. 15). The ornament of the glabella and fixed cheek consists of a series of tubercles interspersed by much smaller ones.

Geological Horizon and Localities.—Upper Leptæna Limestone of Lissberg, West Baltic Limestone of Öland from boulders, and from an erratic block of clear grey limestone of Pritzerber See, near Brandenburg, Germany.

Deiphon americanus Weller. (Pl. XV. fig. 16.)

1907. *Deiphon americanus* Weller, p. 268, pl. xxiv. fig. 14.

The holotype is preserved in a pale grey, almost white, limestone, and is present as an internal cast. The cephalon alone is known, and this is slightly damaged in the region of the occipital ring, while the glabella is somewhat crushed.

Description.—The cephalon is readily distinguished since the inflated glabellar mass is situated more to the front, relative to the fixed cheeks, than in any other species of *Deiphon*. The ratio of length to breadth is approximately 1 : 2.

Glabella shows a swollen anterior mass and a pair of small basal lateral lobes. In front of each lateral lobe the axial furrow descends abruptly and coalesces with the deep, pit-like, basal lateral furrow. The axial ring is damaged, but it is convex transversely, while the occipital furrow deepens laterally to delimit the hinder margin of the lateral glabellar lobe. The occipital ring is separated medially from the tumid portion of the glabella by a concave area which is composed of more elements than the confluent occipital and basal lateral furrows, for, another furrow (marked x in Pl. XV. fig. 16), which is not differentiated medially, delineates the back of the tumid mass, passes laterally between this mass and the raised region of the eye, and joins the axial furrow. The presence of this furrow (x) is probably due to the fact that the tumid mass is more isolated from the occipital ring than in any other species.

Fixed Cheeks are very slender and originate from the postero-lateral margin of the glabellar mass; it is this postero-lateral position of the fixed cheek which is so distinctive, for generally in *Deiphon* it is placed more forward, and consequently the swollen mass appears to be less separated from the cephalon. No secondary spine has been observed on the fixed cheeks.

Free Cheeks are indeterminate. The eyes are situated posterior to the inflated glabella, and are directed obliquely outwards, but further details are not shown.

The hypostoma, thorax, and pygidium are unknown.

Material and Locality.—The holotype was collected from near Lemont, Illinois, U.S.A. (no. 9899, Walker Museum, University of Chicago).

Geological Horizon.—Silurian : Niagaran Limestone.

Deiphon longifrons, sp. n. (Pl. XVI. figs. 8, 9.)

1901. *Deiphon forbesi* van Ingen, p. 35.
1929. *Deiphon forbesi* Thomas, p. 121, pl. ix. figs. 8 & 9.

Description.—The cephalon shows the general characters of the genotype, and the ratio of the length to breadth is 2 : 5.

Glabella comprises a central tumid portion with diminutive basal lateral lobes (Pl. XVI. fig. 8, *a*). The tumid mass is egg-shaped, and attains a maximum breadth at varying distances in front of the occipital furrow in different individuals; the length is constantly greater than the breadth, and in this respect is different from any previously described species. In side view the mass overhangs and projects well in front of the pre-glabellar furrow, while its axis is tilted upwards at nearly 45° (Pl. XVI. fig. 8, *b*). The basal lateral lobes are small, and basal lateral furrows deep. The axial furrow is generally deep, descends to form a pit in front of the lateral lobes, ascends sharply to attain its greatest height at the level of the eyes, and thence swings inwards and downwards round the front of the glabella as the pre-glabellar furrow; this is not arched medially. The occipital ring and furrow are normal for the genus.

Fixed Cheeks are slender; they curve outwards, then backwards, and finally turn upwards, standing vertical at their extremities. A small secondary spine is present on the frontal border.

Free Cheeks are relatively the smallest found in any species of *Deiphon.* The anterior branch of the facial suture cuts the eye margin well to the front, and there is a pronounced palpebral lobe. The posterior branch, however, leaves the eye-margin at the same level as the anterior branch, and thus nearly the whole of the inferior eyelid is carried on the fixed cheek. The eye is reniform in shape and there are about 200 facets on its surface; the eyes are situated well to the back of the tumid glabellar mass, at a level corresponding to two-thirds its length (Pl. XVI. fig. 9).

The glabella is pustulated and, with the exception of the furrows, the rest of the cephalon is ornamented with small granules.

The hypostoma, thorax, and pygidium are unknown. The material from the St. Clair Limestone is here placed in a new species, for I know of no other form in which the swollen glabellar mass is so elongated, and inclined at such a high angle.

A reconstruction of the cephalon is given in text-fig. 3, *c*.

Material and Locality.—Six specimens were obtained from hills north of Batesville, Arkansas, U.S.A., and include the holotype and paratype (nos. 13891 & 13892, Peabody Museum, Yale University).

Geological Horizon.—Silurian : Clinton ; St. Clair Limestone.

Deiphon pisum (Foerste).

1894. *Sphærexochus pisum* Foerste, p. 528, pl. xxxvii. A, fig. 14.
1904. *Deiphon pisum* Foerste, p. 340.

I have been unable to procure material of this species, which was erected on incomplete specimens. The glabella and occipital ring only are known, and, as far as can be determined from the figures and text, these differ in shape from the genotype.

Localities and Geological Horizons.—Silurian: Clinton Group of Ohio and Indiana ; also reported from Niagaran Shales of Lockport, New York, U.S.A.

Genus Onycopyge H. Woodward, 1880.

Diagnosis.—Tumid portion of glabella unsegmented, transversely oval ; basal lateral lobes present ; occipital ring short ; fixed cheeks divided into subtriangular and spinose portions, the former showing posterior border ridge and furrow, the latter carrying small secondary spine (s^2) along its anterior edge ; free cheeks small, with secondary spine (s') ; eyes protuberant ; hypostoma with pear-shaped middle body, lobate anterior wings. Thorax of nine, possibly eight, segments ; pleuræ with median transverse ridge, anterior and posterior borders ; dorsal tubercle at fulcrum ; interfulcral distance almost constant ; pleural spines recurved and free. Pygidium with seven ankylosed segments ; two pairs of large spines associated with first and second segments ; third pair of blunt spines at posterior margin.

Onycopyge liversidgei H. Woodward. (Pl. XVI. figs. 10–11.)

1880. *Onycopyge Liversidgei* H. Woodward, p. 97, woodcut.
1917. *Onycopyge liversidgei* Etheridge & Mitchell, p. 506.

The holotype was originally incompletely developed ; Mr. Parsons, of the British Museum (Natural History), has now mounted on plaster the face which was exposed when the rock was broken open, and the dorsal surface has been cleared of much of the matrix. Consequently some of the details which were formerly available are now temporarily hidden.

Description.—The proportion of the cephalon length to breadth is approximately 4 : 9.

Glabella comprises an unsegmented, coarsely granulated, tumid mass which is broader than long, and a pair of basal lateral glabellar lobes which are a little more strongly developed than in *Deiphon.* The basal lateral lobes are defined in front and behind by small, shallow, basal lateral and occipital furrows, both of which are confluent with the marked median depression separating the occipital ring from the swollen glabellar mass. The occipital ring is transversely and longitudinally convex (Pl. XVI. fig. 10, *b*). The axial furrow is directed forwards and defines the side of the occipital ring and basal lateral lobe; thence it turns outwards, deepens at the base of the inflated glabella, ascends to a position just internal to the eye, and swings inwards and downwards; but its continuation as the pre-glabellar furrow is unknown.

Fixed Cheek consists of an inner, rather flat, subtriangular region which passes laterally into a stout spine (Pl. XVI. fig. 10, *a*). The posterior border is raised to form a ridge, and carries anteriorly a posterior border furrow *. The ridge and furrow extend outwards from the occipital region and bend slightly forward, thus conforming to the shape of this part of the margin of the fixed cheek; they are not continued into the spinose portion of the fixed cheek, of which the posterior margin is reflected sharply. The cheek is flat in front of the posterior border furrow, but is convex between the eye and the swollen glabella. Near the base of the spinose extremity of the fixed cheek there is a secondary spine (s^2) situated on the frontal margin; in dorsal aspect the spinose cheek appears to be rounded, but in other views is flattened.

Free Cheek is not clearly outlined, but it evidently occurs on the front margin, and occupies a similar position to that in *Deiphon* (Pl. XVI. fig. 10, *c*). There are suggestions that the posterior branch of the facial suture commences internal to the secondary spine (s^2) on the fixed cheek, and the anterior branch extends inwards and forwards from the eye underneath the overhanging glabella. Details of the eye are obscure, but this organ is apparently more elevated than in *Deiphon*, with a tendency towards a pedunculate habit; it is situated on a level with the mid-length of the tumid glabellar mass. The free cheek is provided with a blunt spine (s'), a structure which is absent in *Deiphon*.

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* This is the pleur-occipital furrow of some authors, but for the reasons given by Warburg the term is not adopted here (1925, p. 4).

The hypostoma is incompletely preserved, but such parts as are visible are clearly of the *Deiphon* type (Pl. XVI. fig. 11). The middle body is pear-shaped, while the anterior wing is lobate and fitted into the ventral surface of the cheeks.

The thorax apparently consists of nine segments, but actually there may only be eight (Pl. XVI. fig. 11). The axial ring is bowed forwards and provided with an articulatory half-ring and furrow. The pleuræ extend directly outwards at right angles to the axis as far as the fulcrum. Successive pleuræ touch one another, and at the fulcral point each is provided with a tubercle. External to the fulcrum the pleuræ are prolonged into spines which are recurved and free. From the axial furrow to the fulcral point the pleuræ show a median transverse ridge with flattened anterior and posterior borders, but the pleural spines are smooth. The remarkable feature of the thorax is that the interfulcral distance is approximately the same for each segment, there being only a small difference in breadth between the first and ninth. The axis is practically parallel-sided.

The axis of the pygidium tapers gently (Pl. XVI. fig. 11). The first segment is projected backwards into a pair of curved spines, and is separated from the second segment by deep rib furrows. Another pair of pleural spines are associated with the second segment; they are curved and pointed directly backwards. There are five other segments posterior to the second, which are indicated by small rib furrows placed to the side of the axial furrow; these rib furrows die out rapidly, grading on either side of the axis into a concave area limited anteriorly by the pleuræ of the second segment. The posterior margin of the pygidium is continued into two short spines situated on each side of the mid-line. There are seven ankylosed segments in the pygidium.

A reconstruction of *Onycopyge liversidgei* is given in text-fig. 1, *b*.

Material and Locality.—One specimen, the holotype (no. I 107, B.M.N.H.), has been examined, and this was obtained from near Bombala, New South Wales, Australia.

Geological Horizon.—Silurian.

II. STRUCTURAL COMPARISONS OF THE GENERA AND SPECIES.

A study of the species and varieties included in the genus *Deiphon* indicates that the following structural differences are of importance in the determination of the various forms :—(i.) The normal position of the eyes in the European specimens is opposite the middle of the inflated glabellar mass, but in the American forms they either occur at the postero-lateral extremities (*americanus*), or at a position opposite to the middle of the posterior half of the swollen mass (*longifrons*). (ii.) The anterior branch of the facial suture leaves the eye-margin, in all forms in which it has been seen, in front of the palpebral lobe. The posterior branch, however, can be followed backwards to the inferior eyelid which it cuts at one-half (*forbesi*), at one-half to one-third (*barrandei*), and at one-third (*globifrons*) of the length ; in the extreme case the posterior branch commences so far forwards that most of the inferior eyelid is carried on the fixed cheek (*longifrons*). (iii.) The shape of the enlarged mass of the glabella is variable, but in general the greatest length relative to the breadth is shown in *longifrons* ; *forbesi* may exhibit a greater length than breadth, but individuals usually measure the same in both directions ; *dikella* is spherical, and *globifrons* and *americanus* are subspherical in shape ; *barrandei* generally possesses a greater breadth than length, and *angelini* seems characterized by a subquadrangular mass. (iv.) The median profile of the *D. forbesi* species-group is approximately the same throughout, although the swollen glabella in *globifrons* markedly overhangs the occipital ring. In *americanus* the glabella is obviously more distinct from the occipital ring than in any other form, while in *longifrons* the inclination at 45° of the major axis of the glabellar mass is certainly diagnostic. (v.) The pre-glabellar furrow often shows a slight median dorsal flexure, but this is absent in *longifrons*. (vi.) The thoracic pleuræ are smooth except in the genotype, where, according to Barrande, there is a median groove. (vii.) The angle of divergence of the posterior pair of pygidial spines is a useful feature for identifying the varieties of *D. forbesi*; pygidia of other species are unknown. The angles are: *D. forbesi barrandei*, adult 180°, young about 85°; *D. forbesi*, adult 150°, young 110°; *D. forbesi globifrons*, adult 100°, young 90°; and *D. forbesi dikella*, presumed adult 70°. Although pygidial spines are well known to be misleading in differentiating trilobite species, yet in such a highly specialized form as *Deiphon* it seems possible to rely to a certain degree upon these structures when singling out the varieties of the genotype. (viii.) Of the varieties of *D. forbesi*, *barrandei* is on the whole more coarsely granulated, especially in the region of the free cheek; the general appearance of the adult of this type suggests old age characters.

Many of the structural features given above are individually insufficient to isolate the various forms, and this is even more the case when dealing with *Deiphon forbesi* and its varieties. Such a condition suggests that the European representatives comprise a small species-group, and my preference for maintaining the forms as varieties and not as species helps to direct attention to their close similarity, whereas the erection of new species often hides this very relationship. If, however, the so-called varieties are considered to be of more than varietal importance, then the real difficulty lies in the selection of those characters which are sufficiently important to be accepted as specific in rank. In the European examples of *Deiphon* I can see no pronounced differences which justify the elevation of the forms to new species, yet there are definitely certain variations which are too isolated in their occurrence to be explained by fluctuations on either side of an average as is found in communities. Such being the case, these specimens are taken as varieties within the *Deiphon forbesi* species-group.

A comparison of the reconstructions of *Deiphon* (text-fig. 1, *a*), *Onycopyge* (text-fig. 1, *b*), and *Sphærocoryphe* (King, 1920, pl. xiii.) immediately shows the close structural similarity of the genera. The greatest differences are shown in the cephala, for the thoraces and pygidia are obviously constructed on the same general plan. *Onycopyge* can be considered as a form heralding, but not necessarily ancestral to, the *Deiphon*-type of cephalon, in which the characteristic glabella has already appeared, but the extreme spinose shape of the fixed cheek has not yet been attained. Thus the *Deiphon*-type could reasonably have been developed from an *Onycopyge*-like form by a further reduction inwards of the fixed cheek of the latter, and by the consequent loss of the posterior border furrow. The spines present at the postero-lateral corners of the cephalon in *Onycopyge* are probably intergenal spines, and thus it follows by analogy that the two spinose processes of *Deiphon* are nothing more than intergenal spines developed back on to the cephalon by the reduction of the fixed cheeks proper. Thus *Deiphon* seems almost to have reduced its cephalon to the minimum condition that was anatomically possible.

Although the cephalon of *Deiphon* could have arisen by the reduction of the *Onycopyge*-type of fixed cheek, yet it is equally evident that *Deiphon* is nearly related to *Sphærocoryphe*, particularly in the shape of the hypostoma, and could have been, and probably was, derived from this genus. In *Sphærocoryphe* the reduction of the fixed cheeks to spinose processes and the migration of the eyes antero-laterally would have resulted in the peculiar and specialized form of the *Deiphon* glabella. The three genera herein mentioned are unquestionably related, and *Deiphon*, which is the most specialized member, could have evolved almost directly from either *Onycopyge* or *Sphærocoryphe*; but since the former is only Australian in occurrence and the latter both European and American, the more probable ancestral type to *Deiphon* is *Sphærocoryphe*.

III. MODE OF LIFE.

Dollo considered *Deiphon* as a free-swimming animal which inhabited the euphotic zone, and he founded his conclusions on the presence of such characters as the globose glabella, the marginal eyes, the depressed body, and the flat and spinose pygidium (1910, p. 409). Staff and Reck argued that the animal was not so much a free-swimming form as one which floated in the surface waters of the sea; the criteria which they selected were the spinose outline and the fact that the pygidium is almost useless as a swimming organ (1911, p. 144). Raymond thought that the swollen glabellæ of trilobites probably denoted an adaptation to a mixed or vegetable diet, but was unprepared to apply this too strictly, "for the swollen glabellæ of such genera as *Deiphon* or *Sphærexochus* may be due merely to the shortening up of the cephalon" (1920, p. 103). In this connection it is noteworthy that in some pelagic crustacea, such as *Mimonectes,* certain spaces within the body are filled with a colourless transparent fluid, of which the specific gravity is presumed to be less than that of sea water (Calman, 1911, p. 145); it is worthy of consideration whether the anomalous tumid glabella of *Deiphon* likewise may have partly contained some comparable fluid. Also in these pelagic crustacea the surface exposed to the sea is increased by means of a development of spines, and consequently greater friction is brought into play. This increased friction retards sinking, and possibly provides intervals of rest to the swimming organism (*op. cit. supra,* p. 147). Thus might the spinose condition of *Deiphon* be attributed to a provision for intervals of rest, but whereas in the crustacea mentioned above there is an increase in area by the formation of spines, in *Deiphon* the area is decreased, for the spines have arisen by an extensive reduction of the more compact form which the ancestral types must have possessed. On the other hand, if it be allowed that the test possessed a greater specific gravity than sea water, then a form in which the test had been so reduced as in *Deiphon,* would, in comparison with a normally developed compact type of the same overall dimensions, be relatively very much lighter. The reduction in the test is here attributed to an attempt to decrease volume and hence mass, and this, associated with the swollen glabella, probably resulted in such an increase in buoyancy as to enable the animal to float. The float-like glabella and the appendages with which the animal was provided would have resulted probably in the animal living inclined to the surface of the sea, the glabellar mass being largely, but not entirely, submerged. As the body in life probably was in an inclined position, the eyes, which in dorsal view face obliquely upwards and forwards, would have been directed nearly vertically upwards, and, by nature of their convexity and numerous facets, would have controlled a wide field of vision. For similar reasons as given above, the mode of life of *Onycopyge,* and incidentally *Sphærocoryphe,* was probably like that propounded for *Deiphon.*

IV. STRATIGRAPHY.

The genus *Deiphon* is usually considered to be a typical Silurian fossil (Barrande, 1871, p. 58; Jones, 1925, p. 383; Ulrich, 1926, p. 319), and, with the possible exceptions of *D. angelini* and a very doubtful occurrence in the Richmondian of Iowa (Ulrich, 1926, p. 319), this opinion is still tenable. *D. angelini* occurs in the Upper Leptæna Limestone, and Warburg considers that the Formation is of Upper Ordovician age (1925, p. 412). More recently, a thin series of graptolitic shales cropping out at Kallholn in Dalarne has been stated to be truly interbedded with the Limestone, and not occurring as a fissure infilling as was previously supposed (Troedsson & Roswall, 1926, p. 444). Should this opinion be correct, then a certain part of the Upper Leptæna Limestone at this locality must be placed in the Birkhill (Silurian), for the graptolites are referable to the Zones of *Monograptus gregarius* and *M. leptotheca.* On the other hand, Strand has shown from his study of the cephalopods that Upper Ordovician forms found in the Gastropod Limestone (5 *a*) of Oslo are also represented at Kallholn (1933, p. 107). Hence it may be that the Upper Leptæna Limestone of Kallholn is partly of Upper Ordovician and partly of Silurian age. The near relationship of *D. angelini,* recorded from rocks *in situ* at Lissberg, to Silurian species of *Deiphon* raises the question whether that part of the Limestone which yielded the specimens may not also belong to the Silurian.

Apart from *D. angelini* and the material recorded from the Richmondian of Iowa, all other species occur in the Silurian. Valentian representatives are known from Britain and from the Upper Medinan (Brassfield) of Ohio and Kentucky, but these latter specimens I have not been able to trace. The genus became wider spread in Salopian times, being known from the Wenlockian of England and Bohemia, the Gotlandian of Sweden, the Niagaran Limestone of Illinois, the Niagaran Shales of New York, the St. Clair Limestone (Clinton) of Arkansas, and the Clinton of Ohio and Indiana. Barrande appears to have labelled many of the fossils from the E_1 horizon as from E_2, for Perner and Kodym, when writing on the reef-facies in Barrande's Étage E, refer *Deiphon forbesi* to E_1, and remark that " in the immediate neighbourhood of these coral reefs there seems to be a peculiar trilobite fauna, represented by *Bronteus planus*, *Cheirurus insignis*, *Sphærexochus mirus*, *Deiphon forbesi*, *Lichas*, etc., the true horizon of which belongs to E_1, as I have found them in mudstones and limestones associated with *Retiolites geinitzianus*, *Cyrtograptus murchisoni*, *Monograptus priodon*, and *M. vomerinus* " (1922, p. 61). The horizon of this fauna is Wenlockian (Zone of *C. murchisoni*). The highest level at which *Deiphon* has been discovered is, apparently, in the $E\beta$ beds (Ee_2 of Barrande) of Bohemia (but see above), which may be correlated by means of their fauna carrying *Monograptus ultimus* and *M. transgrediens* with the top two zones of the Lower Ludlow of Britain (Heritsch, 1928, p. 339). The genus has not been found, so far as I am aware, in Upper Ludlow or younger sediments.

Onycopyge is known at one locality only in Australia, and the beds are not more precisely dated than Silurian.

I wish to express my gratitude for the kindly assistance, both in sending specimens and in providing necessary information, which I have received from Dr. Elsa Warburg, Dr. C. Casper, Dr. C. O. Dunbar, Dr. Jan Koliha, Dr. E. Kummerow, Dr. A. W. Slocom, Dr. E. Stensiö, Dr. N. L. Thomas, Dr. A. H. Westergård, and from the authorities of the British Museum (Natural History), the Museum of Practical Geology, and the University Museums of Cambridge, Oxford, and Birmingham. A grant from the Publications Committee of the Royal Society enabled me to invite Miss Joyce Townend to prepare the illustrations which are reproduced in the Plates.

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EXPLANATION OF THE PLATES.

Plate XV.

Deiphon forbesi Barrande (see p. 506).

Fig. 1. Dorsal view of cephalon, right eye and left side of occipital ring damaged. Ee_1 beds of Lodenitz, Bohemia, no. I 3420 (B.M.N.H.). ×2.

Fig. 2. Oblique front view to show anterior (*a.f.*) and posterior (*p.f.*) branches of the facial suture, and the eye (*e*). Narodni Museum, Prague. ×2.

Fig. 3. Dorsal view of pygidium showing three pairs of spines, the smallest and most anterior of which articulates with posterior pair of pleuræ of the thorax. Narodni Museum. ×2.

Deiphon forbesi globifrons (Angelin) (see p. 510).

Fig. 4. Incomplete cephalon showing ornament on inflated glabellar mass. Gotlandian Limestone of Fårö, Gotland, no. Ar 6194 (Riksmus. Stockholm). ×2 approx.

Fig. 5. Worn specimen showing small free cheek, anterior (*a.f.*) and posterior (*p.f.*) branches of the facial suture, and the eye. Gotlandian Limestone of Fårö, no. Ar 6182 (Riksmus.).

Fig. 6. (*a*) Dorsal view of incomplete cephalon showing swollen glabella overhanging the occipital ring, and sturdy fixed cheek. (*b*) Front view of the above with the free cheek missing but showing perfectly the anterior (*a.f.*) and posterior (*p.f.*) branches of facial suture, palpebral lobe, and part of inferior eyelid. Gotlandian Limestone of Fårö, no. Ar 6177 (Riksmus.). Both illustrations, ×2.

Fig. 7. (*a*) Ventral view of hypostoma showing antero-lateral wing on left side, posterior to which is the lateral protuberance of uncertain function. (*b*) Dorsal view of the above. Gotlandian Limestone from canal west of Hall, Gotland no. Ar 6157 (Riksmus.). Both illustrations, ×2·4.

Fig. 8. Ventral view of cephalon showing on left side the bifid lateral inlet for hypostoma attachment, notch (*n*), groove (*g*), and facial suture (*f.s.*). Gotlandian Limestone of Fårö, no. Ar 6182 (Riksmus.). × 1·8.

Fig. 9. Ventral view of cephalon showing bifid inlet on right side (lettering as in fig. 8). Gotlandian Limestone of Fårö, no. Ar 6196 (Riksmus.). × 2.

Fig. 10. Swollen glabellar mass showing coarse ornament. Gotlandian Limestone of Fårö, no. Ar 6157 (Riksmus.). × 2.

Fig. 11. Incomplete pygidium. Gotlandian Limestone of Fårö, no. Ar 6154 (Riksmus.). × 2.

Fig. 12. Almost complete pygidium with the smallest and most anterior pair of articulatory spines clearly defined. Gotlandian Limestone of Likkershamn, Gotland, no. Ar 6153 (Riksmus.) × 2.

Fig. 13. Incomplete cephalon from a derived block found at Oliva, near Danzig. × 2 approx.

Deiphon angelini Warburg (see p. 517).

Fig. 14. Incomplete cephalon figured by Warburg (1925, pl. x. fig. 40), but here shown in dorsal view. Upper Leptæna Limestone of Gulleråsen, near Lissberg, Dalarne. (Sveriges Geol. Unders. Museum). × 2.

Fig. 15. Cephalon showing part of the fixed cheek on left side with eye region broken. From a derived block (probably of Upper Leptæna Limestone) from Pritzerber See, near Brandenburg, Germany. × 2.

Deiphon americanus Weller (see p. 519).

Fig. 16. Internal cast of cephalon (occipital ring damaged) showing the extra groove (*x*) referred to in the text on p. 519. Niagaran Limestone of Lemont, Illinois, no. 9899 (Walker Museum, Chicago). × 2.

PLATE XVI.

Deiphon forbesi barrandei, var. nov. (see p. 513).

Fig. 1. Complete specimen, the holotype, from the Wenlock Shales of the Malverns (University Museum, Oxford, Grindrod Collection). × 2.

Fig. 2. Almost complete cephalon showing eye on right side and secondary spine on fixed cheek. Wenlock Shales of Dudley, no. 58953 (B.M.N.H., John Gray Collection). × 2.

Fig. 3. Nearly complete pygidium. Wenlock Limestone of Dudley, no. A 3296 (Sedgwick Museum, Fletcher Collection). × 2.

Fig. 4. Front view of cephalon showing hypostoma in place, the eyes, and the anterior (*a.f.*) and posterior (*p.f.*) branches of facial suture. Wenlock Shales of the Malverns (University Museum, Oxford, Grindrod Collection). × 2.

Deiphon forbesi cf. *dikella*, var. nov. (see p. 517).

Fig. 5. Internal cast of incomplete cephalon. Upper Valentian (Pentamerus Beds), near Wagbeach, Shropshire, no. 53479 (Museum of Practical Geology). × 2.

Fig. 6. Side view of internal cast of incomplete cephalon. The specimen is tilted up on the plate. Purple Shales (arenaceous development) of the Bog Mine, Shelve, Shropshire, no. 53480 (Museum of Practical Geology). × 2 approx.

Deiphon forbesi dikella, var. nov. (see p. 516).

Fig. 7. (*a*) Internal cast showing crushed cephalon, thorax, and incomplete pygidium. Lower Valentian (Gasworks Mudstones) of Haverfordwest, South Wales, no. A 3507 *a* (Sedgwick Museum. (*b*) External mould of the same individual as above showing ornament on glabella, thorax, and broken pygidium, no. A 3507 *b* (Sedgwick Museum). Both illustrations, × 1·3 approx.

Deiphon longifrons, sp. n. (see p. 520).

Fig. 8. (*a*) Incomplete cephalon showing elongation of glabella. (*b*) Side view of above to show tilted up tumid glabellar mass. Clinton (St. Clair Limestone) of Batesville, Arkansas, no. 13892 (Peabody Museum, Yale). Both illustrations, × 2.

Fig. 9. Cephalon showing eye and fixed cheek on right side; the holotype. Clinton (St. Clair Limestone) of Batesville, Arkansas, no. 13891 (Peabody Museum, Yale). × 2.

Onycopyge liversidgei Woodward (see p. 521).

Fig. 10. (*a*) Dorsal view of cephalon with two axial rings of thorax. Note posterior border furrow on right side. (*b*) Side view of above. (*c*) Oblique front view of above showing the eye region (*e*) and the two spines (s' and s^2), here broken, of the free and fixed cheeks. Silurian of Bombala, New South Wales, Australia, no. I 107 (B.M.N.H.). All illustrations × 1·4 approx.

Fig. 11. Same individual as in fig. 10, but showing on another slab the hypostoma (*h*) with its left antero-lateral wing (*w*), the two spines (s' and s^2) of the free and fixed cheeks, the thorax, and the pygidium. Silurian of Bombala, New South Wales, no. I 107 (B.M.N.H.). × 1·3 approx.

LIII.—*On the* Pyralidæ *collected by Messrs. F. le Cerf and G. Talbot in the Great Atlas of Morocco.* By Dr. Anton Schmidt, Section-Director of the Hungarian National Museum in Budapest.

[Plate XVII.]

A short account of the expedition to the southern slopes of the Great Atlas undertaken by M. F. Le Cerf and Mr. G. Talbot in 1927 was published in the Bull. Hill Museum, ii. 1, p. 89, where an itinerary of the route taken, with a list of all the localities visited and dates, is also given. A list of the Macrolepidoptera collected is to be found in the Bull. Hill Museum, ii. 2, pp. 101–121. The Microlepidoptera—excepting the Pyralidæ—were dealt with by Mr. E. Meyrick in pt. 3, pp. 232–240.

Some years ago my colleague, Mr. F. le Cerf, Curator at the National Museum of Natural History, Paris, was so kind as to give me the opportunity to work out the Pyralidæ from the Great Atlas, and, later on, Mr. Talbot, Curator of the Hill Museum, asked me to do the same.

In the following I give the enumeration of the Pyralidæ with descriptions of some new species. The holotypes of the new species have been placed in the British Museum.

I wish here to place on record my grateful thanks to the above-mentioned two gentlemen; to Prof. H. Rebel at the Natural History Museum in Vienna for his assistance concerning the determination of some doubtful specimens; and also to Mr. W. H. T. Tams for his great help in the preparation of this article.

Pyralidæ.

GALLERIINÆ.

Aphomia sociella ab. *obscura* nov.: considerably darker and uniformly slate-brown, with the central part of the fore wings not lighter, as it is generally in typical specimens. One specimen: Tinmel, zone of lavenders, 19. v. 27, at light.

CRAMBINÆ.

Crambus mauretanicus Müller-Rutz; nearly all specimens uniformly dark, except a few in which a light antemarginal band is present and a row of light spots between this antemarginal band and the border. Most of the specimens are from Tachdirt and south slopes of Djebel Tachdirt (2500–2600 m.), 5. vi. 27. Two specimens from Arround, one W. slopes 2200 m., taken in wind and cold fog, the other one E. slopes to 2500 m., 30. v. 27. Length of fore wings, 11–12 mm.; expanse, 22·5–24 mm.

Eromene joiceyella, sp. n. (p. 538).

Eromene ocellea Haw.: Tinmel, S.E. slopes, 20. v. 27, at light.

ANERASTIINÆ.

Anerastia ablutella Z.: Tinmel, S.E. slopes and in the Oued, 18–20. v. 27, at light.

Anerastia ablutella ab. *bimaculella* Rag.; one specimen, Tinmel, in the Oued, 18. v. 27.

Phycitinæ.

Homœosoma nimbella Z.: Tinmel, zone of lavenders, 19. v. 27.

Homœosoma subalbatella Mann: one specimen from Tinmel, S.E. slopes, 20. v. 27, at light.

Ephestia figulilella Gregs.: 3 specimens from Taroudant, Sous dist., 25. iv. 27, Garden of Kasbah, at light.

Ephestia welseriella Z.: Tenfecht, 2000–4000 ft., dry season, at light, 30. iv.–1. v. 27.

Ephestia disparella Rag.: Tinmel, 21. v. 27, at light, in rain.

Syria lecerfi, sp. n. (p. 539).

Syria menonoma, sp. n. (p. 539).

Heterographis ephedrella H.-Sch.: Tinmel, zone of lavenders, 19. v. 27, at light.

Euzophera nelliella Rag.: Tenfecht, 3000–4000 ft., dry season, at light, 30. iv.–1. v. 27.

Ocrisia robiniella Mill.: Tinmel, zone of lavenders, 19. v. 27, at light.

Epischnia prodromella Hb.: Tinmel, S.E. slopes, 20–22. v. 27.

Epischnia illotella Z.: Tinmel, 23. v. 27, at light, in storm, and Tenfecht, 3000–4000 ft., dry season, at light, 30. iv.–1. v. 27.

Salebria subductella Zerny: Tinmel, zone of lavenders, 19. v. 27 and 22. v. 27, in rain. One specimen from Tizi N. Test and Djebel Imress, 2000–2450 m., 11–14. v. 27. Ground-colour of fore wing light yellowish grey. The type in the Vienna Natural History Museum is rufous.

Salebria brephiella Stgr.

Acrobasis obliqua Z.: Tinmel, S.E. slopes, 20. v. 27, at light.

Myelois nivosella Rag.: Tinmel, 22. v. 27, at light, in rain.

PYRALINÆ.

Aglossa pinguinalis subsp. *maroccana*, nov. (p. 540).

Aglossa ifniensis, sp. n. (p. 541).

Aglossa atlassica, sp. n. (p. 542).

Pyralis obsoletalis Mn.: Tinmel, zone of lavenders, 19. v. 27, at light.

Pyralis farinalis subsp. *meridionalis*, nov. (p. 543).

Dattinia kasbahella, sp. n. (p. 543).

HYDROCAMPINÆ.

Duponchelia fovealis Z.: Tinmel, 22. v. 27, at light, in rain. 1 specimen: Taroudant, Sous district.

Stenia punctalis Schiff.: two ♂ specimens, Great Atlas, Arround, 2000–2500 m. One (Pl. XVII. fig. 3), 29. v. 27, at light, near refuge; the other on the east and S.E. slopes to 2500 m., 31. v. 27. One small ♀ taken at Sinis (2800 ft.), dry season, at light, on plateau, 6. v. 27.

Stenia daralis Chrét.: all specimens caught in the neighbourhood of Tinmel in the zone of lavenders, S.E. slopes, in the Oued, in rain. Only one, with more prominent markings, from Tenfecht, 3000–4000 ft., dry season, at light, 30. iv.–1. v. 27.

SCOPARIINÆ.

Scoparia talboti, sp. n. (p. 544).

Scoparia ingratella Z.: Lake Ifni, south edge below lake, 2. vi. 27.

Scoparia pyrenæalis Dup.: 1 specimen, Djebel Tachdirt, S. slopes, 2400–2600 m., 7. vi. 27.

PYRAUSTINÆ.

Nomophila noctuella Schiff.: this cosmopolitan species was frequently taken at Tinmel, 22–23. v. 27, at light, in rain and storm.

Phlyctænodes comptalis Frr.: one specimen, Tinmel, 21. v. 27, at light in rain.

Phlyctænodes nudalis Hb.: two damaged specimens, one taken at Ouaounzeurt, Tifnout, on slopes by streams, 3. vi. 27, the other at Tafingoult, 1100–1400 m., 10. v. 27, at light.

Diasemia ramburialis Dup., Tinmel, 19. v. 27.

Titanio pollinalis Schiff.: Arround, east slopes to 2500 m., 30. v. 27.

Metasia suppandalis Hb.: two males, Korikla and Forest of Zaers, near stream, Rabat District, 17. vi. 27. Two females, Sinis, 2800 ft., dry season, at light on plateau, 6. v. 27.

Pionea testacealis Z.: Tinmel, 23. v. 27, at light in storm.

Pionea ferrugalis Hb.: Tinmel, S.E. slopes, 20–23. v. 27, at light also in rain. One specimen, Arround, 2000 m., 29. v. 27, at light near refuge.

Pionea numeralis Hb.: Tinmel, S.E. slopes, 20. v. 27, at light; Sinis, 2800 ft., dry season, at light on plateau, 6. v. 27; Taroudant, Sous district, 20–24. iv. 27, dry season, fields in the plain.

Pyrausta arroundella, sp. n. (p. 545).

Pyrausta asinalis Hb.: Tenfecht, 3000–4000 ft., dry season, at light, 30. iv.–1. v. 27.

Pyrausta cespitalis Schiff. var. *intermedialis* Dup.: Djebel Tachdirt, S. slopes, 2400–2600 m., 7. vi. 27.

Pyrausta sanguinalis L.: Tinmel, S.E. slopes, 20. v. 27, at light, Tafingoult, 1100–1400 m., 10. v. 27, at light.

Pyrausta aurata Scop. var. *meridionalis* Stgr.: Tenfecht, 3000–4000 ft., dry season, at light, 30. iv.–1. v. 27. Amongst them one aberrant female with a lighter yellow medial area on fore wing.

Noctuelia floralis Hb. var. *stygialis* Tr.: Tinmel, 24. v. 27; Taroudant, Sous district, 20–24. iv. 27, dry season, fields in the plain; Tachdirt and S. slopes of Djebel Tachdirt, 2400–2600 m., 5–7. vi. 27; Kasba Taguendaft, 2000–2450 m., 16. v. 27; Ouaounzeurt, Tifnout, on slopes by stream, 3. v. 27.

Eromene joiceyella, sp. n. (Pl. XVII. fig. 4.)

In size, in its elongate wings, and in pattern nearest to *E. pulverosa* Chrét.

Length of fore wing 10 mm.; expanse 19–20 mm.

Head, palpi, and thorax uniformly bright yellowish brown. Ground-colour of *fore wings* yellowish brown, with sharply-defined dark markings, whilst in *pulverosa* the ground-colour is grey and all markings much finer and paler. Especially across the apex the transverse streak, extending from the costal margin to the outer margin, as well as the median transverse band, are strikingly dark brown, so that the clay-yellow colour in the middle is hardly noticeable. The median band is straighter, as in *ramburiella* Chrét.; proximally it is bordered by a fine bright line, which is not waved towards the inside, and also the broken double transverse streak is filled in by bright colouring at the apex and along the outer margin. From the inner angle up to the middle of the outer margin there are only three metallic-golden shining oblong patches which have on the outside a black border towards the margin and are accompanied proximally by six small square rich black dots, these being arranged in the same way as with *pulverosa*, *ramburiella*, and *superbella*, only there is in these three species above the middle of the outer margin still a fourth golden patch with two extra black dots.

Between the black dots, and basad, the entirely yellow scales, which separate the metallic shining patches, together with their black borders, into groups, and which extend to the outer margin, are particularly prominent here.

Fringes on the fore wing yellowish brown, dark-edged, interrupted by white and yellow.

Hind wing uniform bright brownish grey, somewhat darker than in *pulverosa*, the fringes bright whitish grey, with the basal third fuscous.

Hab. Great Atlas: Tinmel, caught at light in the zone of lavenders, S.E. slopes, in the Oued, 18–21. v. 27, one of the specimens taken in rain.

Type in the British Museum, and co-types in the National Museum of Natural History, Paris, and in the Hungarian National Museum, Budapest.

Syria lecerfi, sp. n. (Pl. XVII. fig. 9.)

Great Atlas: two specimens, Tinmel, zone of lavenders, 17–19. v. 27, at light; one specimen caught at Tenfecht, 3000–4000 ft., within the dry period around 30 April and 1 May, 1927.

Size. Length of fore wing 7–8 mm.; expanse 14–16 mm.

Fore wing uniform bright ochre-yellow, at the nervures and at the outer margin powdered with cinnamon-red to reddish-brown scales, which spread uniformly over the whole surface of the wing, and in one of the specimens totally suppress the ground-colour. The third specimen entirely without pattern, the fore wing edged narrowly with black at the termen, the black edging gradually narrowing towards the tornus. The terminal line is bright grey. The fringes are greyish black, divided by a brighter grey line.

Hind wings uniform whitish grey with a yellowish silky gloss, sparingly powdered with blackish-grey scales. Terminal line a dark blackish grey.

Fringes a dirty whitish grey divided by a somewhat darker line.

Underside of the fore wing dark brownish with a yellowish silky gloss; a fine bright yellowish line along the costa, ending somewhat before the apex with a rounded-off dot of the same colour. Underside of hind wing is of one colour, shining whitish grey. Head and thorax the same as the ground-colour with an admixture of reddish scales.

Antennæ reddish brown; abdomen bright yellowish ochre.

Type in the British Museum, and co-types in the National Museum of Natural History, Paris, and in the Hungarian National Museum, Budapest.

Syria menonoma, sp. n. (Pl. XVII. fig. 10.)

Head and thorax warm buff irrorated with fuscous-black, antenna ringed with fuscous-black, palpus with second segment banded with fuscous-black, third segment fuscous-black; abdomen warm buff with some fuscous-black shading, tibiæ warm buff irrorated with fuscous-black. *Fore wing* warm buff irrorated with fuscous-black; a short sub-basal black streak on hind margin of cell; an oblique fuscous-black antemedial fascia curved (concavity basad) below costa, preceded at a distance equal to its own width by a fine indistinct fuscous-black parallel line; two distinct fuscous-black discoidal dots; postmedial fascia of two fuscous-black parallel lines, almost straight and gradually converging tornad as it approaches the inner margin; a pre-terminal row of fuscous-black spots, and a terminal line; fringe warm buff tinged with fuscous. *Hind wing* light buff, termen and costa tinged with fuscous.

Holotype ♀: Tinmel, 20. v. 1927. *Paratype* ♀: Tinmel, 19. v. 1927.

Aglossa pinguinalis L. var. *maroccana*, nov.

(Pl. XVII. fig. 7.)

1 ♂, 2 ♀♀. Great Atlas, Tinmel, in the zone of lavenders, 19th May, 1927, at light.

Size. ♂, length of fore wing 14 mm.; expanse 27·5 mm. ♀, length of fore wing 17–19 mm.; expanse 34–39 mm.

Ground-colour brighter than that of the typical *pinguinalis*, more yellowish grey and consequently rather resembling var. *asiatica* Ersch., having a slight reddish tinge, and therefore the dark markings show much greater contrasts. The markings are not blackish brown, but a dark reddish brown (darker in the ♀); their position is exactly the same as in *pinguinalis*, except the two sharp median transverse bands, which are placed closer to each other at the costal margin as in var. *asiatica*. The second median transverse band is placed quite near the middle of the cell.

Fringes yellowish or reddish brown on both wings, brighter and longer than in the typical form, with a distinct dark dividing-line.

Hind wings: colour brighter than in *pinguinalis*, as is also the median band, which is more prominent. The fringes of the hind wings are yellowish grey, brighter at the base, with a feeble dividing-line.

Underside: similar to that of the typical form, but the hind wings much brighter with very distinct pattern, whilst in *pinguinalis* these markings are, on the contrary, quite indistinct or obsolete.

Types: 1 ♂, 1 ♀, British Museum.

Paratype: 1 ♀, Hungarian National Museum, Budapest.

Aglossa ifniensis, sp. n. (Pl. XVII. fig. 5.)

1 ♂, Great Atlas: Lake Ifni, south edge below lake, 2. vi. 27.

Similar to *cuprealis* Hübn., but larger, with more obsolescent, broader, sprinkled markings.

Length of fore wing 13 mm.; expanse 26 mm.

Ground-colour as in *cuprealis*, a bright sandy-yellow with similarly distributed bright chocolate-brown oblong patches. The outer dentate bright submarginal band, occupying the same position as in *cuprealis*, is much heavier at the costal and inner margins, forming a broad strikingly oblong patch in both places. The narrow marginal area remains dark between the submarginal band and the outer margin.

The median bright transverse streak is broader than in *cuprealis* and also extends from the costal margin to the centre of the wing, and the central area is broadly brightened at the third transverse streak, which borders the dark transversely cut basal area.

The marginal line is sandy yellow on the fore and hind wing.

Fringes yellowish grey on the fore wing, chequered chocolate-brown, with a bright dividing-line.

Hind wings: whitish grey with a yellowish-silky gloss, gradually darkening to blackish brown towards the margin. The submarginal band is indistinct and strongly dentate. Fringes whitish grey with a dark dividing-line.

Underside nearly uniformly chocolate-brown, against which the yellow marginal line stands out sharply, and whereas in *rubralis* nearly all markings are prominent below, here only two rounded-off dots exist to represent the submarginal band and the median band at the costal margin; on the hind wing the strongly serrate submarginal band is distinctly to be seen. Head, thorax, and tegulæ a dark chocolate-brown with a yellowish admixture.

Palpi a sandy yellow on the inner side, from above and towards outside a dark blackish brown, the terminal line bordered with yellow basad.

The yellowish antennæ are bipectinate and dark-ringed. Abdomen brighter yellowish grey, with a silky gloss.

Holotype in the British Museum.

Aglossa atlassica, sp. n. (Pl. XVII. fig. 8.)

1 ♂, Great Atlas: caught in Tinmel, 22. v. 1927, at light, in rain.

Size. Length of fore wing 12 mm.; expanse 23·5 mm.

Ground-colour a bright reddish-ochre-yellow with irregularly spread brownish-red patches, similar to *ocellaris* Led., both species having also a silky gloss.

The dark markings can, in these specimens, be best regarded as three transverse bands, divided into smaller spots which more or less coalesce; they are as follows:—

(*a*) The marginal band, which here consists only of three sharply separated spots, in the following arrangement:—At the apex there is an oblong spot, in the middle of the margin a patch which is composed of crowded smaller ones, and at the tornus a round spot.

Then follows:—

(*b*) The broad median band, considerably attenuated in its upper half and becoming gradually narrower from the costa towards the inner margin. Its anterior part resembles a recumbent letter "M." The arm touching the costal margin always bears at the costa 3–4 light round dots, and below these still a row of tiny light dashes. The lower part of the median band consists of the second arm of the "M" and of an oblong patch touching the inner margin, these being connected by three dark lines, and here enclosing two light round spots, the larger of which shows a dark nucleus.

At the base of the costal margin are two dark dashes.

(*c*) Separated from the costal dashes by the light ground-colour is the basal oblique third transverse band, bordering the light area, and appearing narrow and interrupted in the middle.

The light ground-colour of the fore wings is irrorated with small brownish-red scales.

Fringes whitish yellow variegated with reddish scales.

Hind wings yellowish whitish-grey, darkened blackish grey towards the margin with a narrow light submarginal band. Fringes of the hind wings proximally yellowish, distally whitish grey, with darker line at the basal third.

Underside of the fore wings.—The apex is, up to the beginning of the median band, which is cut sharply at the costa, ochre-yellow, while the marginal line (and similarly the whole marginal area) is whitish yellow; the whole median and basal area is dark reddish and the outer margin is dark reddish brown along the costa. At the end of the cell there is a rounded-off ochre-yellow spot.

Underside of hind wings.—Except the ochre-yellow marginal line, uniform whitish yellow and at two-thirds of the costal margin darker, irrorated with reddish brown.

Head, palpi, and antennæ a bright brownish yellow, the latter bearing fine cilia. Thorax brownish red.

Holotype in the British Museum.

Pyralis farinalis subsp. *meridionalis*, nov.

Much larger in size than the typical form of *farinalis* and also much darker.

Fore wings more brown than yellow.

Length of fore wings 13 mm.; expanse 27 mm.

A good difference is to be seen on the hind wings, the two white transverse lines not being so prominent and sharply defined as in the typical *farinalis.*

We have very similar specimens from Tunis. It is also possible that the Moroccan specimens constitute a distinct species, which is widely distributed in the southern part of the Palæarctic region, but more material and genitalia researches are necessary.

The specimens are all females, and most of them were taken at Taroudant, Sous district, Jan. to April (*Mons. Triaud*), while a few are from Aguerd-el Had (3400 ft.), dry season, valley of stream north side, 3–4. v. 27.

Type in the British Museum and co-types in the National Museum of Natural History, Paris, and in the Hungarian National Museum, Budapest.

Dattinia kasbahella, sp. n. (Pl. XVII. fig. 11.)

1 ♀, found at Taroudant, Gardens of Kasbah, 25. iv. 27, at light.

Size. Length of fore wing 9 mm.; expanse 18·5 mm.

Near *staudingeralis* Rag. and *lobesalis* Chrét., but while in these species the middle area is always brighter than the basal area, these areas are uniformly dark in *kasbahella,* filled out by a yellowish-blackish-brown colouring, rendering the white transverse bands more prominent, besides which the middle area is also a great deal narrower and has a white dot in the cell. Otherwise the pattern is the same as in *lobesalis*. Fringes chequered. The *hind wings* have a light band before the dark margin, and are of a darker tawny than the species mentioned above, the fringes being similarly somewhat darker. Head, thorax, and abdomen of ground-colour, the latter white-ringed at each segment.

The holotype is in the British Museum.

Scoparia talboti, sp. n. (Pl. XVII. fig. 6.)

May best of all be compared with *Scoparia sudetica* Z., though generally larger than *sudetica*.

Length of fore wing 10–12 mm.; expanse 20–24 mm.

May be distinguished from *sudetica* at first sight by the upper side of the fore wings, these appearing somewhat reddish brown and being much more parti-coloured. Also the pattern, especially in the case of the white transverse lines, is much finer in *sudetica* and the spots more uniformly greyish brown. In the new species the two white transverse lines, especially the outer one, are uniformly much broader, and similarly the undivided white arched streak in the darkened marginal area is also much broader. Both transverse lines are proximally edged with blackish brown; this, together with the scattered clay-yellow dots (which are especially striking in the median mark and at the interior transverse line) gives an appearance which is much richer in contrasts.

Concerning the position of the outer dentate dark transverse line, it is indeed somewhat variable in the individual specimens; it resembles, however, that of *sudetica*, though forming a more flat arc, not appearing broken in the same way. The second interior transverse line is more oblique towards the outer margin than in *sudetica*, less curved and with rather sharp angulations. The edging of the interior streaks in the middle area is broken up into irregular blackish-brown patches, the upper one being enlarged to an oblong ring filled out with clay-yellow colouring, whereas the one in the middle has sometimes a sagittate appearance. Similarly, there are usually at the base several short dark dashes in fan-shape arrangement.

The outer stigma, which consists of two open rings, is edged with black, the inside of the rings being filled in with clay-yellow colouring.

Fringes a bright yellowish grey, as in *sudetica*, light brown at the ends, and at the endings of the nervures chequered with white.

Hind wings somewhat darker than in *sudetica*, more brownish grey, with a yellowish-silky gloss. The fringes, as in *sudetica*, brighter yellowish grey, with a dark dividing-line.

The *underside* also resembles that of *sudetica*: brownish grey. The dark outlines of the oblique transverse lines of the fore wing show through distinctly in the middle area, with apparent continuations on the hind wings, not reaching the margin. Sometimes the outer stigma is well defined also. Head, thorax, abdomen light, as in *sudetica*, slightly more yellowish brown, as are also the dark-ringed antennæ and the palpi if looked at from above. Beyond the middle, as well as laterally, they are dark brown, the terminal segment being bright again. Viewed from below the palpi are blackish brown and the terminal segment is white.

The specimens, all ♂♂, originate from the Great Atlas: Arround (2000 m.), 29. v. 27, from Mr. Talbot and Custos Le Cerf caught at light.

Type in the British Museum, and co-types in the National Museum of Natural History, Paris, and the Hungarian National Museum in Budapest.

Pyrausta arroundella, sp. n. (Pl. XVII. figs. 1, 2.)

Near *P. catilualis* Hmps., though considerably larger (about double the size of *catilualis*), with very narrow long fore wings.

Size. Length of fore wing 15 mm.; expanse 30 mm.

Ground-colour of the fore wings a bright chocolate-brownish with a prominent yellow design of patches, which border the two transverse lines distally, while the outer transverse line is also proximally edged with a short series of yellow patches, the latter arranged beyond and round the end of the cell, but not reaching the costa. This yellow design of patches is considerably reduced in most of the specimens, rather in the same way as in *lutulèntalis* Ld., so that occasionally only single spots, and perhaps the central spot in the cell, may be present.

In the ♀ the yellow designs appear obsolescent, as if they were shining through from below.

Hind wings: a darker grey than in *catilualis*, brightened in the central area and at the base with two obsolescent interrupted transverse lines, the outer of which is edged distally with a not very distinct series of yellowish patches.

Fringes of both wings dark, somewhat brighter than the ground-colour, yellowish at the base with two dark lines running through them.

Underside: grey with a yellow sheen, with the pattern distinctly visible from above.

Head, antennæ, and thorax of the ground-colour, palpi dark brown from above, only the terminal segment somewhat darker, proximal half laterally whitish; abdomen a lighter grey than the ground-colour with bright yellowish ringed segments.

Great Atlas: most of the specimens Arround (2000 m.), 29. v. 27, at light, near refuge, some specimens from Tachdirt and south slopes of Djebel Tachdirt (2450–2600 m.), 6. vi. 27.

Type in the British Museum, and co-types in the National Museum of Natural History, Paris, and in the Hungarian National Museum, Budapest.

EXPLANATION OF PLATE XVII.

Fig. 1. *Pyrausta arroundella* Schmidt, sp. n., type ♂.
Fig. 2. Ditto, allotype ♀.
Fig. 3. *Stenia punctalis* Schiff., ♂.
Fig. 4. *Eromene joiceyella* Schmidt, sp. n., type ♂.
Fig. 5. *Aglossa ifniensis* Schmidt, sp. n., type ♂.
Fig. 6. *Scoparia talboti* Schmidt, sp. n., type ♂.
Fig. 7. *Aglossa pinguinalis maroccana* Schmidt, subsp. n., type ♀.
Fig. 8. *Aglossa atlassica* Schmidt, sp. n., type ♂.
Fig. 9. *Syria lecerfi* Schmidt, sp. n., type ♀.
Fig. 10. *Syria menonoma* Schmidt, sp. n., type ♀.
Fig. 11. *Dattinia kasbahella* Schmidt, sp. n., type ♀.

LIV.—*New Fossil Mammals from Olduvai, Tanganyika Territory*. By A. TINDELL HOPWOOD, D.Sc., F.L.S., Department of Geology, British Museum (Natural History).

THE material on which the following diagnoses are based was collected in 1931 and 1932 by the British East African Archæological Expedition, leader Dr. L. S. B. Leakey. All the types are preserved in the Department of Geology of the British Museum (Natural History). The numbers refer to the Departmental Registers. The horizon given for each species is that stratum in which the types were found; the range throughout the series will be given in the final report. There are four beds, of which Bed I. is the oldest and Bed IV. the youngest; the general geological age is Middle Pleistocene.

Order PRIMATES.

Family **Cynopithecidæ**.

Genus SIMOPITHECUS Andrews, 1916.

This genus differs from *Theropithecus* in its face, which is shorter; in its canine fossa, which is hardly developed; in its teeth, which are narrower and have more slender cusps.

Simopithecus leakeyi, sp. n.

Diagnosis.—A *Simopithecus* in which the length of the second lower molar is approximately 40 per cent. greater than that of *S. oswaldi* Andrews.

Holotype.—A crushed left mandibular ramus of a young male with dm_4, M_1 in wear, and C, P_{3-4}, M_2 still in the crypts, but exposed by dissection. Registered M 14680.

Paratype.—A left maxilla with M_{2-3} in full wear. Registered M 14681.

Horizon.—Holotype, Bed IV.; paratype unknown.

Dimensions (in mm.).—

		Length.	Breadth.	Index.
Lower.	dm 4	12·5	9	72
	M 1	16·4	12	73
	M 2	21·5	16	74
Upper.	M 2	16·7	13·5	81
	M 3	18·2	14	77

Order ARTIODACTYLA.

Family **Suidæ**.

Genus KOIROPOTAMUS Gray, 1843.

Koiropotamus majus, sp. n.

Diagnosis.—A *Koiropotamus* with very large upper tusks; three well-marked areas of enamel on each tusk; the antero- and postero-superior areas 12–14 mm. wide, inferior area up to 40 mm. wide near the base of the tusk. Main cusp of lower P_4 more definitely bifid than in Recent species. Length of lower P_2—M_1 about 40 per cent. greater than in Recent species.

Holotype.—Part of a left mandibular ramus with P_3—M_1 and the alveolus for P_2. Registered M 14682.

Paratypes.—Two upper tusks, probably of the same individual. Registered M 14683.

Horizon.—Holotype, Bed IV.; paratypes, Bed I.

Dimensions (in mm.).—

		Length.	Breadth.	Index.
Lower.	P 3	16	9·8	61
	P 4	19·8	13·5	68
	M 1	25	14	56

Length P_2—M_1, 69 mm.

Genus NOTOCHŒRUS Broom, 1925.

This genus differs from *Metridiochœrus* Hopw. in that the pillars which make up the crown of the third upper molar are coarser, fewer in number, and have thicker enamel than in *Metridiochœrus.* The discovery of true third lower molars at Olduvai proves that the holotype of *N. capensis* Broom is also an upper tooth.

Notochœrus dietrichi, sp. n.

Diagnosis.—A *Notochœrus* with smaller and less complicated upper molars than the genotype, *N. capensis.*

Holotype.—A third upper molar. Registered M 14684.

Paratype.—A broken mandible with the second and third left molars intact. Registered M 14685.

Horizon.—Holotype and paratype are from Bed II.

Dimensions (in mm.).—

		Length.	Breadth.	Index.
Upper.	M 3	61	23·5	38·5
Lower.	M 2	31·5	16	51
	M 3	58	16	27·5

The measurements are taken at the grinding surface.

Remarks.—The species is named after Dr. W. O. Dietrich, Berlin, to whom so much of our knowledge of the Olduvai fauna is due.

Family **Giraffidæ.**

Genus HELLADOTHERIUM Gaudry, 1866.

Helladotherium olduvaiensis, sp. n.

Diagnosis.—A *Helladotherium* in which the lower teeth are 25–30 per cent. longer than in *H. duvernoyi*, but with P_4 relatively 10–17 per cent. narrower.

Holotype.—A right fourth lower premolar. Registered M 14200.

Paratypes.—(*a*) A rolled fragment of a right mandibular ramus with P_4—M_1. Registered M 14686. (*b*) A partial hind-limb. Registered M 14687.

Horizon.—Holotype and M 14687, Bed I.; M 14686 unknown, but probably Bed II.

Dimensions (in mm.).—

		Length.	Breadth.	Index.
M 14200	P 4	44	30	68
M 14686	P 4	44	33	75
	M 1	55	35	64

Remarks.—Although the teeth are as large as specimens of *Sivatherium*, the metatarsal is about the same size as those of *H. duvernoyi*.

Family **Bovidæ.**

Genus PULTIPHAGONIDES, gen. nov.

Diagnosis.—Bovidæ with widely divergent (120°) horn-cores, gently twisted, spiral of the left one clock-wise; amount of twist from half to three-fourths of one revolution; horn-cores in plane of face, with a definite keel above and below, the upper one apparently the stronger.

Genotype.—*Pultiphagonides africanus*, sp. n.

Pultiphagonides africanus, sp. n.

Diagnosis.—A *Pultiphagonides* with long narrow nasal bones; no lachrymal fossa ?; supra-orbital pits fairly large and somewhat sunken; face bent down on the basi-cranial axis at about 45°; teeth moderately hypsodont, with well-marked ribs, but no basal pillar.

Holotype.—An adult skull lacking the right horn-core, much of the basi-cranial region, and the premaxillæ. Registered M 14688.

Horizon.—Bed II.

Dimensions (in mm.).—

Condylo-basal length	250+
Greatest breadth	156
Palatal length	120+
Greatest length of nasals	124+
Greatest width of nasals	41
Maxillary tooth-row (left)	93
Length of horn-core	130+
Maximum diameter at base	47
Minimum diameter at base	42

Remarks.—This species bears no very close resemblance to any of the living African Bovidæ, and its affinities are uncertain. The generic name is taken from Plautus.

Genus PARMULARIUS, gen. nov.

Diagnosis.—Bovidæ with relatively short, subparallel horn-cores, and a long narrow face. Horn-cores on a short pedicel, curved gently backwards and outwards, neither keeled nor twisted. Lachrymal fossa of medium depth; supra-orbital pit small, lying at the upper end of a shallow groove, not sunken. Nasals long and narrow. Face bent down on basi-cranial axis at about 65°. Brain-case with a median conical parietal boss.

Genotype.—*Parmularius altidens*, sp. n.

Parmularius altidens, sp. n.

Diagnosis.—A *Parmularius* with very hypsodont teeth. Height of first upper molar 42 mm.

Holotype.—An associated skull and mandible, with the cervical vertebræ and other parts of the skeleton. Registered M 14689.

Horizon.—Bed I.

Dimensions (in mm.).—

Condylo-basal length	320
Greatest breadth	130
Palatal length	210 est.
Greatest length of nasals	149
Front of orbit to tip of premaxilla	228
Length of horn-core	80+ (100 est.)
Maximum diameter at base	32
Minimum diameter at base	28
Maxillary tooth-row	95
Mandibular tooth-row	97
Mandibular diastema	76

Remarks.—Apparently an aberrant member of the hartebeeste group.

LV.—*Dr. Obenberger and the Genus* Stigmodera.

By H. J. Carter, B.A., F.R.E.S.

In Časopis Česk. Spol. Entom. xxx. čisl. 2 (1933) Dr. Jan Obenberger has published "Notes on the Australian Genus *Stigmodera* Eschs. (Col.)." The twenty-one pages of this paper include :—

(A) Reasons for the validity of species that I had considered as synonyms.

(B) Descriptions of three species as new.

(C) Descriptions of variations under three heads—subspecies, variations, and aberrations (the last an added terror to the student). New names are given to forty-eight varieties and forty-four aberrations.

(D) Statements that need correction.

Dr. Obenberger criticizes my tabulation for "being based on the superficial colour characters . . . . which, indeed, make the determination easy." On p. 340 of the Austr. Zool. (1931) I gave as the chief reason for this use of colour that my table was "intended for use in museums and by collectors who need a ready guide for determinations." Since Dr. Obenberger admits that this object is attained, it is a little unkind of him to call it names—"has the signs of a simple Prodromus."

With regard to (A) : in the case of *S. jakovlevi, queenslandica, mrazi, semenovi, circumflexa, dorsalis,* and *ciceri*ni I see no reason for changing my opinion as to the synonymy stated in my Check List (1929, Aust. Zool. App. 302). With *S. carteri* and *S. yilgarni* there remain elements of doubt. In the case of *S. strandi* and *S. nickerli* I now think I was mistaken in considering them as *S. maculiventris* Macl., though I still think—as Kerremans did when applying the same MS. name to both—that they are merely colour varieties of the same species. I would again urge this author to employ the most decisive way of testing synonymy—comparison with type—when possible, by way of confuting criticism.

With regard to (B) : *S. danesi* is clearly distinct from recorded species ; *bazilisca* must be very near some of the numerous variations of the widely distributed *simulata* C. & G., *lacerta* must be near *iospilota* C. & G., but there is apparently an error in the stated dimensions (9 × 1·7 mm.) of the last, a proportion of length to breadth unknown in the genus.

With regard to (C): the addition of ninety-two varietal names—in most cases applying to the commonest species, in which almost any number of colour variations occur—is regrettable and of little value; I have stated the only cases in which I think varieties deserve a special name (Aust. Zool. 1931, p. 340) in this genus. The term "aberration" has long been used to denote freakish structures—malformations, hermaphrodite Lepidoptera, and the like,—so that its employment to denote mere variations of pattern is undesirable, while the attempt to draw the line between variation and aberration will involve endless confusion.

With regard to (D):—*S. rufipennis* Kirby: the change in the synonymy under my no. 22 (Aust. Zool. 1931, p. 250) should perhaps have been more fully explained, but is not "erroneous." The information here contained is one of the many things I owe to Dr. K. G. Blair, of the British Museum, who wrote "*parallela* Snds. (nom. præocc. White)=*croceipennis* C. & G. C. & G.'s figures are quite conclusive; fig. 21 has the broad thorax with subangulate sides and deep foveæ on disc of *rufipennis*, whereas fig. 20 has the rounded, narrower thorax of *croceipennis*. The extent of the black apex is immaterial . . . These are two perfectly distinct and readily separable species. Both Hope and C. & G. were of this opinion, and it is only subsequently that they have been confused." Concurring in this, I did not follow the traditional catalogue synonymy.

S. sexplagiata C. & G.: I have already discussed the confusion under this name (Proc. Linn. Soc. N.S.W. 1924, p. 521, and Aust. Zool. 1931, pp. 362, 363) and the difficulty of identifying *crenata* Don. (nec C. & G.). It seems indefensible to use the later name *variata* Kerr. for this well-known species, of which the fig. (under *plagiata*) is satisfactory (*vide* Art. 18, Rules of Entomological Nomenclature proposed by the Brit. Nat. Committee).

S. burchelli C. & G.: Dr. Obenberger contradicts my assertion of the trispinose apices of this species. If he will again read the original description he will find the words "légèrement triépineuses à l'extrémité" therein.

The figure does not show this, but the description of the author must take precedence before the artist's drawing.

I have spent much time, both at the British Museum and in Australian museums, over the variations and distribution of *simulata* C. & G. and *burchelli* C. & G., and the evidence is clearly in favour of the arrangement as in Austr. Zool. 1931, p. 366 *.

S. burchelli has only been recorded from Western Australia (the original habitat). *S. simulata* is widely spread in all the States.

S. perlonga Cart.: Dr. Obenberger places this as a variety of *S. atricollis* Saund.; but in Saunders' description and figure the pattern is very different from *perlonga*. In *atricollis* the subbasal markings vary, but are always present, while the dark sutural vitta is absent in the many examples seen. The habitat stated on the label of *perlonga* is Sydney perhaps (Wilson in Coll. Saunders). *S. atricollis* is only known from South and Western Australia.

S. rubrocincta Gehin: Dr. Obenberger's words "There seems to be some trouble in the synonymy of this species and of *S. scalaris* Boisd." revive the mistake in the older catalogues that was corrected by Kerremans (Gen. Ins.). Gehin's species, of which I have a long series from Bunbury, W.A., and have taken at Bridgetown and elsewhere in W.A., differs considerably from *scalaris* in its more cylindric form, more sharply spinose apices, often brassy prothorax, sanguineous sides of the elytra, and other distinctions. The further arrangement of *rubrocincta* Geh. and *cyanicollis* Boisd. under the nomen nudum *S. subtrifasciata* Hope is another twofold lapse. (1) *S. subtrifasciata* was published in the much-discussed paper "Buprestidæ" (?1836) that was privately circulated and not recognized by Saunders and other authors (see Proc. Ent. Soc. Lond. 1867, pp. cix, cx., also Saunders' note in Trans. Ent. Soc. Lond. 1868, p. 2, and my note in Trans. Ent. Soc. Lond. 1923, p. 69), all of which are presumably known to the editor of the Junk Catalogue of Buprestidæ. (2) *S. cyanicollis* Boisd. is only one of the many colour-forms of *S. scalaris* Boisd. This renders some two and a half pages of this paper, with the seven "aberrations" and one var. thereon, difficult to clarify. Indeed, the paper provides a fair mark for the derision of those zoologists who already regard the systematic entomologist *de haut en bas.*

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* In a letter to me Dr. Blair writes: "I think that *burchelli* C. & G. is identical with *hopei* Saund., both names being founded on *burchelli* Hope." (Though Saunders describes the elytral apices as "bidentate" the suture forms a minute third tooth.—K. G. B.)

LVI.—*A Note on the Nomenclature of the Species of the* "subtilis" *Group of the Genus* Sicista. By J. L. Chaworth-Musters. (From the Department of Zoology, British Museum (Nat. Hist.).)

In this paper I shall only deal with those species of this genus which belong to what may be termed the "*subtilis*" group—that is, those forms with a distinct dorsal stripe in contrast to the "*concolor*" group which have no such stripe.

The first species definitely belonging to the genus *Sicista* was described by Pallas under the name of *Mus subtilis* (Reise d. versch. Prov. Russ. Reiche, vol. ii. p. 705). The main description deals with an animal "color supra cinereocanescens, fusco-mixtus; fasciola latiuscula . . . nigra." In this description Pallas also describes an unnamed variety "fulvescenti-luteo." Reference to the text (*loc. cit.* vol. ii. p. 328) shows that the specimens upon which Pallas based his description of *Mus subtilis* were obtained by Sokolof somewhere along the lower reaches of the Ural River or on the shores of the Caspian Sea.

Later Pallas (Nov. Spec. Glir. Ord. p. 90, 1778) divides his *Mus subtilis* into two species: *Mus vagus* ("corpore cinereo") based upon his *Mus subtilis* and *Mus betulinus* ("corpore fulvo") based upon the unnamed variety cited above. The first locality mentioned for this last species is "in betuletis camporum Ischimensium," which must be regarded as the type-locality.

There can be no doubt that *Mus subtilis, vagus,* and *betulinus* of Pallas all refer to species of what is now considered the genus *Sicista*; the very long tail and the stripe down the back are diagnostic. There can also be no doubt that Pallas realized that he was dealing with two distinct species.

Examination of a series of striped birch-mice from Europe and Western Asia shows that there are two species with just those diagnostic characters given by Pallas :— One species with grey sides and back, to which the names *subtilis*, *vagus*, *nordmanni*, *loriger*, and *trizona* have been given, and another species with brownish-yellow sides, to which the names *betulinus*, *montana*, and *norvegica* have been given. Although the two forms differ only in colour, and their ranges have not yet been shown to overlap, recent work by Vinogradov (Proc. Zool. Soc. 1925, pt. ii. pp. 576–585) on the character of the penis has shown them to be specifically distinct. As Pallas's descriptions are clear and unambiguous, his names must be retained.

Nathusius (in ' Nordmann Demidoff's Voyage,' vol. iii. p. 49) described a species under the name of *Sminthus loriger*, which may, at the moment, most conveniently be considered as a geographical race of *Sicista subtilis* (Pallas). In the same year, Keyserling and Blasius (Wirbelt. Europ. pp. x & 38) described the same specimens under the name of *Sminthus nordmanni*, but as they show later (Archiv f. Naturgesch. 1840, vi. vol. i. p. 330) this must be considered a synonym of *Sminthus loriger*.

Later Petenyi (' Termesetrajzi Fuzetek,' vol. v. p. 103) described a species under the name of *Mus trizona*, which has been shown by Mehely (Ann. Mus. Nat. Hung. vol. xi. p. 220) to be a race of *Sicista loriger* (Nathusius) and not, as considered by Miller (Cat. Mamm. West-Europe, p. 539), related to the northern brownish species *Sicista betulina* (Pallas).

Sicista montana Mehely and *Sicista norvegica* Chaworth-Musters must, unless they are regarded as synonyms be considered as races of *Sicista betulina* (Pallas).

It is unfortunate that the way in which the names given to these two distinct species have been used indiscriminately by various authors has obscured the true relationships of the species.

The synonymy of this group may be arranged as follows :—

Sicista subtilis subtilis (Pallas).

1773. *Mus subtilis* Pallas, Reise d. versch. Prov. Russ. Reiche, vol. ii. p. 705.

1778. *Mus vagus* Pallas, Nov. Spec. Glir. Ord. p. 90 (renaming of *Mus subtilis*).

1823. *Mus lineatus* Lichtenstein in Eversmann, Reise nach Buchara, p. 123 (R. Usumburta).

Type-locality.—Mouth of Ural River.

Sicista subtilis loriger (Nathusius).

1840. *Sminthus loriger* Nathusius in Nordmann Demidoff's Voyage, vol. iii. p. 49.
1840. *Sminthus nordmanni* Keyserling & Blasius, Wirbelt. Europ. pp. x & 38.

Type-locality.—Odessa, S. Russia.

Sicista subtilis trizona (Petenyi).

1882. *Mus trizonus* Petenyi, Termesetrajzi Füzetek, vol. v. p. 103 (with alternatives *interzonus*, *interstriatus*, *tripartitus*, *virgulosus*, and *tristriatus*).

Type-locality.—Felsno Besnyo, Hungary.

Distribution.—Plains of Hungary, Eastern Rumania, Bulgaria, Crimea, Southern Russia, and the Steppes of Western Siberia, east as far as Irkutsk.

Sicista betulina betulina (Pallas).

1778. *Mus betulinus* Pallas, Nov. Spec. Glir. Ord. p. 90.

Type-locality.—Banks of R. Ischim, N. Siberia.

Sicista betulina montana Mehely.

1913. *Sicista montana* Mehely, Allatani Kozlemenyek, vol. xii. p. 69 (in Hungarian) *.

Type-locality.—Zuberecz, Hungary.

Sicista betulina norvegica Chaworth-Musters.

1927. *Sicista norvegica* Chaworth-Musters, Ann. & Mag. Nat. Hist. ser. 9, vol. xix. p. 542.

Type-locality.—Surendal, Nordmore, Norway.

Distribution.—Carpathian Mts., Denmark, Central Norway, Finland, east into Siberia.

LVII.—*On the Nomenclature of certain Species of the Genera* Allactaga *and* Alactagulus. By J. L. Chaworth-Musters. (From the Department of Zoology, British Museum (Nat. Hist.).)

When reviewing the nomenclature of the Dipodidæ it became obvious that, if the International Rules of Zoological Nomenclature are to be consistently followed, radical changes must be made in the names of certain species of the genera *Allactaga* and *Alactagulus*. Changes of names are always unfortunate, especially where, as in one of the cases dealt with in this paper, they incur the transfer of a well-known and generally used name from a common and well-known animal to one that is little known to general zoologists. With generic names it is possible to uphold *nomina conservanda*, but with specific names this is impossible owing to the fact that the type-locality cannot be changed, and it would be absurd to give, as the type-locality, a locality where the species in question was quite unknown. In my opinion names which invite a transfer should be regarded in certain cases as "*nomina expurganda* (or *delenda*)" *, but until some agreement is reached upon this point I shall abide by the International Rules of Zoological Nomenclature.

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* For German description, see Ann. Mus. Nat. Hung. vol. xi. p. 246.

Gmelin (Nov. Comm. Acad. Sci. Petrop. vol. v. p. 351) gives the first scientific description of any species definitely belonging to what is now considered the genus *Allactaga*. Gmelin's name "*Cuniculus pumilio saliens cauda longissima*" is not binomial and cannot be accepted, although, as "*Allactaga saliens* (Gmelin)," it has been generally used by zoologists for the large *Allactaga* of Southern Russia and Western Siberia. But in his description Gmelin definitely states of his species "in campis Tschikoiensibus, Argunensibus et Onensibus sedem sibi fixit," which, together with the very clear description, shows that he was describing the small *Allactaga mongolica* (Radde) from Transbaikalia and not *Allactaga saliens* auct. from Southern Russia.

The next name given to a species of this genus is *Mus jaculus* Pallas (Nov. Spec. Glir. Ord. p. 87, 1778), but this name, although it has been adopted by mammalogists as "*Alactaga jaculus* (Pallas)," is preoccupied by *Mus jaculus* Linnæus (Syst. Nat. 10th ed. p. 63, 1758), which refers to the Egyptian species *Jaculus jaculus* (Linn.). The varieties described by Pallas in the "*Glires*" cannot be accepted as names, as in a book written throughout in Latin they must be regarded as descriptive terms *. The same objection applies to the names *Lepus terrestris* and *Jerboa sibirica*, given by Pallas (*loc. cit.*) in the synonymy of *Mus jaculus*, as these names are literal translations of Erd-hase and Siberian Jerboa of the authors cited.

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* In regard to the names dealt with in this paper I should suggest that *Mus saliens* Shaw should be regarded as a "*nomen expurgandum*." (Other examples are *Lepus timidus* Linn. and *Turdus musicus* Linn.)

The first real name which can be accepted for any species of this genus is *Mus saliens* Shaw (Nat. Misc. vol. ii. pl. 38, 1790 †). Shaw's description is based upon Brisson's description of *Cuniculus pumilio saliens*, which, in turn, is copied from Gmelin. Although Shaw records his species as occurring in Barbary and Syria, as well as in Siberia beyond Lake Baikal, he undoubtedly describes an *Allactaga* based upon Gmelin's description and gives it a valid name. The type-locality of *Mus saliens* Shaw must be regarded as "Transbaikalia." Under the present Rules of Zoological Nomenclature Shaw's name "*saliens*" must be adopted for the East Siberian and Mongolian species of *Allactaga*, and it is exceedingly unfortunate that it involves transferring this name from the large and well-known species of Southern Russia and Western Siberia. The name usually given to the East Siberian species was *Allactaga mongolica* (Radde) but recently this form has come to be regarded as a race of *Allactaga saltator* (Eversmann) from the Altai; both these names are, however, antedated, not only by *Mus saliens* of Shaw, but, since the true identity of Gmelin's species is made clear, by a number of others.

The transfer of the name "*saliens*" and the disqualification of the name *Mus jaculus* Pallas for the South Russian species incurs a change of name for that species. Certain mammalogists have, before now, regarded both the above names as invalid and have used the name *Allactaga decumanus* (Lichtenstein) for this species, but further research has shown that this name is antedated by *D*[*ipus*] *sibiricus major* ‡ Kerr (Anim. Kingd. p. 274, 1792). Kerr (*loc. cit.*) describes a species of *Allactaga* under the name of *D*[*ipus*] *sibericus* and divides it into four varieties. In his description of the main species he refers to *Mus saliens* Shaw, and his *Dipus sibericus*, together with the variety *media*, must be regarded as synonyms of it. *D[ipus] sibiricus major* from " between the Caspian Sea and the Irtish River " refers undoubtedly to the *Allactaga saliens* auct., the large species from South Russia and Western Siberia, and, as it is the earliest name, it must be adopted for this species.

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* See Thomas, Ann. & Mag. Nat. Hist. ser. 6, vol. xx. p. 309.

† For date of publication, see Sherborn, Ann. & Mag. Nat. Hist. ser. 6, vol. xv. p. 375 (1895).

‡ Kerr, Anim. Kingd., is definitely binomial, and where trinomials are used they are varieties.

Further, *D[ipus] sibiricus pumilio* Kerr (*loc. cit.* p. 275) from the same locality as *D[ipus] sibiricus major* Kerr refers to *Alactagulus acontion* (Pallas), which name it antedates by nineteen years.

A complete synonymy of the species in question is appended, and it is hoped that it will make these most unfortunate changes in nomenclature clear.

Allactaga saliens (Shaw).

1790. *Mus saliens* Shaw, Nat. Misc. vol. ii. p. 38 (Transbaikalia).

1792. *Dipus sibericus* Kerr, Anim. Kingd. p. 274.

1792. *Dipus sibiricus media* Kerr, Anim. Kingd. p. 274 (Transbaikalia).

1800. *Dipus alactaga* Olivier, Bull. Soc. Philom., Paris, vol. xi. pl. iv. p. 121.

1817. *Dipus brachyurus* Blainville, Nouv. Dict. Hist. Nat. 2nd ed. vol. xiii. p. 126 (Transbaikalia).

1828. *Dipus halticus* * Illiger, in Lichtenstein, Abhandl. Akad. Wiss. Berlin, 1925, p. 154 (Transbaikalia).

1848. *Dipus saltator* Eversmann, Bull. Soc. Imp. Nat. Moscow, vol. xxi. no. 1, p. 188 (Tchuya Steppe, Altai).

1861. *Dipus jaculus* var. *mongolicus* Radde, Mél. Biol. Imp. St. Pétersburg, vol. cxi. p. 680 (N. Gobi).

1867. *Dipus annulatus* Milne-Edwards, Ann. Sci. Nat. Paris, ser. 5, vol. vii. p. 376 (Mongolia).

1900. *Alactaga suschkini* Satunin, Zool. Anzeiger, vol. xxiii. no. 610, p. 139 (Desert Ssasa-Kopa, S. of Irgis Turgai).

1911. *Allactaga mongolica longior* Miller, Proc. Zool. Soc. Washington, vol. xxiv. p. 54 (15 miles N.E. of Ching-ning-Chow, Kansu, China).

1912. *Allactaga grisescens* Hollister, Smithson. Misc. Coll. vol. lx. no. 14, p. 3 (Chuisaja Steppe, 8 miles S. of Kosch Agatsch, Altai).

1914. *Allactaga ruckbeili* Thomas, Ann. & Mag. Nat. Hist. ser. 8, vol. xiii. p. 571 (R. Ussek, Djarkent, Central Asia).

Allactaga major (Kerr).

——. *Allactaga saliens* auct. (nec Gmelin).

1778. *Mus jaculus* Pallas, Nov. Spec. Glir. Ord. p. 87 (name preoccupied).

* *Dipus halticus* Illiger (Abhandl. Akad. Wiss. Wien, 1804–1811, p. 62, is a *nomen nudum*. Lichtenstein, *loc. cit.* gives a description.

1792. *D[ipus] sibiricus major* Kerr, Anim. Kingd. p. 274. (Between Caspian Sea and River Irtish).
1828. *D[ipus] spiculum* Lichtenstein, Abhandl. Akad. Wiss. Berlin for 1825, p. 154 (Barnaul, N.W. Altai).
1828. *D[ipus] decumanus* Lichtenstein, Abhandl. Akad. Wiss. Berlin for 1825, p. 154 (Slatoust, Ural).
1840. *Dipus vexillarius* Eversmann, Bull. Nat. Moscow, no. I, 1840, p. 42 (no type-locality).
1843. *Alactaga aulacotis* * Wagner, Abhandl. Mürchener Akad. 1843, vol. cxi. p. 211 (Arabia, ? error).
1844. *Alactaga (Scirteta) jaculus* var. *macrotis* (subvar. *flavescens* et *nigricans*) Brandt, Bull. Acad. Imp. Sci. St. Petersburg, vol. xi. p. 220.
1844. *Alactaga (Scirteta) jaculus* var. *brachyotis* Brandt, Bull. Acad. Imp. Sci. St. Petersburg, vol. ii. p. 220.
1924. *Alactaga jaculus fuscus* Ognev, Rodent N. Caucasus Rostor-on-Don, p. 8 (Tischlovsk, Kizljar, Daghestan).
1931. *Alactaga saliens chaclovi* Martino, Ann. Mus. Zool. Leningrad, vol. xxxi. p. 209 (Karabulak Saissan, Russian Turkestan).

Alactagulus pumilio Kerr.

1792. *D[ipus] sibiricus pumilio* Kerr, Anim. Kingd. p. 275 (between Caspian Sea and R. Irtish).
1811. *Dipus acontion* Pallas, Zoograph. Rosso-Asiatica, p. 182 (Kirghiz Steppes).
1815. *Dipus pygmæus* Illiger, Abhandl. Akad. Wiss. Wien, 1804–1811, p. 62 (*nomen nudum*).
1817. *Dipus minutus* Blainville, Nouv. Dict. Hist. Nat. 2nd ed. vol. xiii. p. 127 (Kirghiz Steppes).
1920. *Alactagulus acontion dinniki* Satunin, Trav. Mus. Georgie, Tiflis, 1920, no. 2, p. 196 (Prikumsk Steppe, N. Caucasus).
1926. *Alactagulus acontion potanini* Vinogradov, C. R. Acad. Sci. U.R.S.S. 1926, p. 233 (Ordos Desert, near Ulan-Morin R., 120 miles S.W. of Kuka-Khoto, N. China).

SUMMARY.

The following names generally used in zoological literature must be changed, viz. :—

" *Allactaga saliens* (Gmelin) "	to *Allactaga major* (Kerr).
—— *jaculus* (Pallas)	
—— *decumanus* (Lichtenstein)	
Allactaga saltator (Eversmann)	to *Allactaga saliens* (Shaw).
—— *mongolica* (Radde)	
Alactagulus acontion (Pallas)	to *Alactagulus pumilio* (Kerr).

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* See Nehring, Zool. Anz. vol. xxv. no. 662, p. 89.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

No. 84. DECEMBER 1934.

LVIII.—*New and little-known Fulgoroidea* (*Homoptera*).

By Dr. FREDERICK MUIR *.

THE present paper is chiefly based on material submitted to me for identification by the British Museum (Nat. Hist.) and the Imperial Institute of Entomology. The description of a new species of *Œclidius* belonging to the Stockholm Museum, however, has been included.

Issidæ.

Padanda ? denti, sp. n. (Fig. 1.)

Brachypterous Female.—Length 4·6 mm.; tegmen 3·2 mm.

Vertex about as long as wide, about half projecting in front of eyes, broadest between eyes, then gradually narrowing to narrow rounded apex; a median longitudinal carina on basal two-thirds; posterior margin slightly emarginate. Length of frons about 1·7 times the width, base broadly rounded, sides slightly curved; the median and medio-lateral carinæ distinct, the basal median portion, between the medio-lateral carinæ, slightly produced, or the lateral portions slightly sunk. In profile the clypeus strongly curved apically; median carina distinct, lateral carinæ not so distinct. Pronotum shorter than vertex, the middle slightly produced anteriorly, tricarinate. Mesonotum wider than long, tricarinate.

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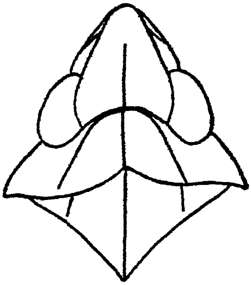
* Dr. Muir died on May 31st, 1931, leaving a number of partly finished manuscripts, of which this is one. It is hoped to publish the remainder as opportunity offers. The types are in the British Museum, unless otherwise stated.—W. E. CHINA, British Museum (Nat. Hist.).

Tegmina reaching to end of abdomen, apex rounded, leathery, convex; *Sc*, *R*, and *M* simple, *Cu* forked before apex of clavus, suture distinct, claval veins forked apical of middle, entering apex of clavus; all the veins raised; no cross-veins. Wings rudimentary.

Hind basitarsus fairly short, apex very slightly widened, with six spines at apex, the outside ones larger than the others; second hind tarsus small, the apex narrowly rounded with a spine on each side.

Fig. 1.



Padanda denti, sp. n.
Dorsal view of head and thorax.

Dark fuscous-brown with some small lighter marks on head, thorax, and legs, hind margins of abdominal sternites light, the apices of ovipositor sheaths light. Tegmina fuscous-brown with lighter small dots, mostly over costal and subcostal cells and over apical portion.

E. Africa: Kenya Colony, Gura River, 7500 feet elevation, 1 ♀ (*R. E. Dent*, August 1929).

Recently I placed the genus *Padanda* in Dictyophoridæ, more on account of general facies than of distinct characters. The present species is not quite typical of the genus, but it is so closely related that I do not feel disposed to erect a new genus for its reception.

But after studying this and the following species (*Spathocranus mikado*) I am unable to retain them in the Dictyophoridæ. They come into one of the Tropiduchid group of families, of which the Issidæ appear to be their best resting-place.

SPATHOCRANUS, gen. nov.

Vertex greatly prolonged in front of eyes, spatulate, widest beyond the middle; the basal portion slightly sunk in the middle; a short median carina not reaching beyond eyes, with a round, slightly sunken area on each side. In lateral view the head prolonged in front of eyes and slightly curved. The frons long and narrow, the base conical in outline, the apex truncate, 5-carinate; the median carina indistinct, the medio-lateral carinæ distinct except at the base; the genæ expanded and slightly curved to accommodate the spatulate vertex. Antennæ small, globose. In lateral view the clypeus angular near apex, three carinate. Thorax wider than head; pronotum roundly projecting anteriorly into base of head, tricarinate on disk, with a single shoulder-keel on each side. The mesonotum short with a fine carina down middle. Tegmina reaching slightly beyond the apex of abdomen, apex rounded; *Sc*, *R*, and *M* simple, *Cu* forked near apex of clavus, claval veins forked beyond middle of clavus, suture distinct. All the veins considerably raised. Wings greatly reduced. Hind basitarsus fairly short, slightly enlarged at apex, which bears eight or nine small spines; second hind tarsus small, the apex broadly rounded with a spine on each side.

Except for the expanded and prolonged head, this genus is closely allied to *Padanda denti*, and must go into the same family. It is unfortunate that I have only one female, as an examination of the male might definitely place the genus.

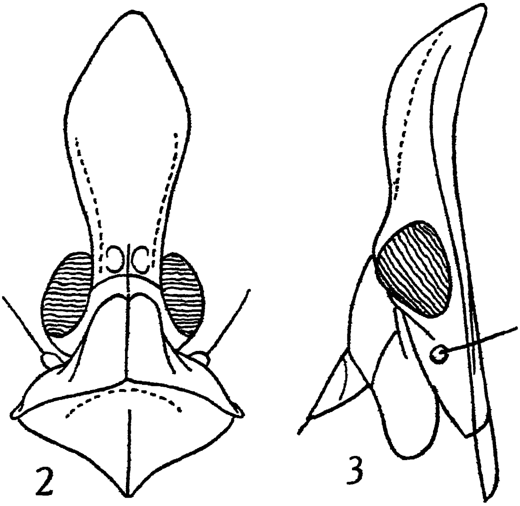
Type, *Spathocranus mikado*, sp. n.

Spathocranus mikado, sp. n. (Figs. 2 & 3.)

Brachypterous Female.—Length 5·2 mm.; tegmen 2·9 mm.

Head, thorax, and front and middle legs dark brown with lighter brown mottlings. Tegmina and hind legs lighter brown with darker mottlings, those on the tegmina mostly along the veins.

Hab. Kenya, Thika, v. 1930, 1 ♀ (*A. F. J. Gedye*).



Spathocranus mikado, gen. et sp. n.
Fig. 2.—Dorsal view of head and thorax.
Fig. 3.—Lateral view of same.

Meenoplidæ.

Eponisia albinervosa, sp. n.

Female.—Length 2·3 mm.; tegmen 4 mm.

This species is quite typical of the genus; the vertex is longer than broad; the first claval vein considerably curved and heavily granulate, the claval veins forking very near the apex of clavus; the $Sc+R$ granulate.

Dark fuscous; the carinæ of head and thorax lighter; femora, tibiæ, and tarsi light. Tegmina fuscous, the veins white, slightly spreading into the cells, especially on cross-veins between R and M 3+4. Wings hyaline with light veins. There is considerable powdery, white, waxy secretion on body, wings, and the granulations of tegmina.

Hab. Uganda, Kinzala (*H. Hargreaves*, 20. xii. 1929). One female.

This is the third species of this genus, the other two being recorded from Formosa.

Derbidæ.

EOCENCHREA Muir.

Eocenchrea Muir, 1913, H.S.P. Exp. Stn. Ent. Bull. xii. p. 32.
Gonyphlepsia Jacobi, 1928, Arkiv f. Zoologi, 19 A, no. 28, p. 39.

G. montis-tympani Jacobi and *G. costalis* Jacobi belong to this genus; *G. angustifrons* Jacobi and *G. venosa* Jacobi, having no median frontal carina, go into *Cedusa* Fowler. Jacobi placed his genus into the Cixiidæ, but the genitalia of both sexes and the short apical segment of the labium show its position is in the Derbidæ.

Eocenchrea albipennis, sp. n.

Male.—Length 2·8 mm.; tegmen 3·8 mm.

Width of vertex nearly twice the length, base and apex straight; length of frons 1·6 times the width, the medio-frontal carina distinct on basal half, indistinct beyond; subantennal process large, shoulder-keel very small, obscure, or a simple carina. $Sc+R$ forking near base; M with five apical veins—1, 1 *a*, 2, 3, 4.

Abdomen damaged and genitalia distorted, so not described.

Yellow; vertex brown. Tegmina milky-white, slightly opaque, fuscous along commissure extending slightly into marginal claval cell, the apical cells slightly fuscous, veins white. Wings opaquely white, veins white.

Female.—Similar in colour and build to male. Pregenital plate short, especially at sides; hind margin slightly curved.

One male and one female from New Caledonia, Bourail, and Noumea (*T. D. A. Cockerell,* 16 & 26. v. 1928).

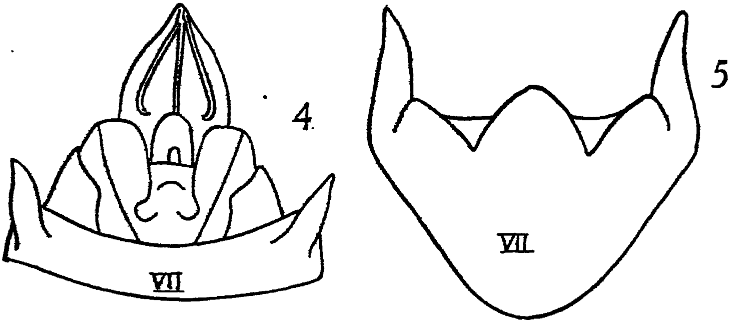
PHENICE Westwood.

Phenice grandis, sp. n.

Female.—Length 5·4 mm.; tegmen 9·2 mm.; wing 6·5 mm.

Antenna about half the length of frons; frons narrow, the lateral carinæ not meeting together; the length of vertex in middle about equal to width of base, base roundly emarginate, an obscure transverse carina separating vertex from frons; the lateral carinæ of vertex and frons fairly thick, beset with sense-pits. Clypeus shorter than frons, tricarinate, the carinæ obscure. *M* with five sectors, the first bifurcate; tegmen broad, the apex broadly rounded; wings with anal area well developed. The ovipositor well developed, the seventh abdominal sternite slightly and roundly produced in middle.

Light stramineous; slightly fuscous on lateral carinæ of frons. Tegmina hyaline with light fuscous markings; over base, a curved mark between the apex of clavus and middle of *Sc* touching base of *Ms* 1, an irregular mark from betweem *Cu* 1 and 1 *a* on hind margin to *C* over base of *Ms* 2, from base of *Ms* 3 to *C*, and smaller markings in apical cells. Veins stramineous, the cross-veins light fuscous. Wings hyaline with stramineous veins, a light fuscous mark on hind margin slightly apical of anal area.



Paraphenice carpentieri, sp. n.

Fig. 4.—Dorsal view of female genitalia.
Fig. 5.—Ventral view of seventh abdominal sternite, showing lateral processes.

Hab. Uganda, Kitambala (*G. H. E. Hopkins*, ix. 1929), one female.

PARAPHENICE Muir.

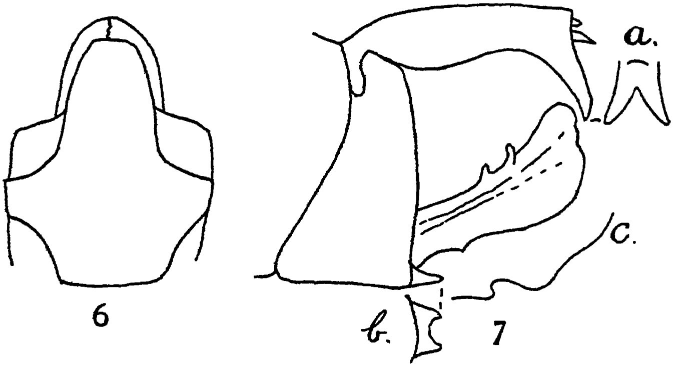
Paraphenice carpentieri, sp. n. (Figs. 4 & 5.)

Female.—Length 4·3 mm.; tegmen 7 mm.; wing 4·8 mm.

Light brown; apex of labium and between the carinæ of mesonotum darker; the pregenital plate and genitalia darker. The clavus, the base of corium, and halfway along the *R* cell light brown, the rest fuscous with lighter spots, slightly fuscous on base of clavus; the lighter spots at base of first three median sectors, four spots along the costa and more faintly on each side of median sector cross-veins; in the fuscous area veins fuscous and in the light area light, except the suture and claval veins which are dark. Wings fuscous with dark veins, light along the basal portion of costa.

The genitalia figured; it is distinct from others by the large pointed process from the sides of the seventh abdominal segment.

Two females from Belgium Congo, Bolingo (*M. Clermont*, 1929). I received these specimens from M. Fritz Carpentier of Liège. Type in British Museum.



Phaciocephalus rubrofasciata Dist.

Fig. 6.—Ventral view of female genitalia.
Fig. 7.—Lateral view of male genitalia. *a.* End view of apex of anal tube. *b.* Ventral view of posterior ventral margin of pygofer. *c.* Ventral edge of genital style.

PHACIOCEPHALUS Kirk.

Phaciocephalus rubrofasciata (Distant).
(Figs. 6 & 7.)

Nisia rubrofasciata Distant, 1920, Ann. & Mag. Nat. Hist. vi. p. 462.

This was described from a female from New Caledonia; I now have one male and four females from New Caledonia, Bourail, and Mueo (*T. D. A. Cockerell*, 19 & 25. v. 1928). I figure the genitalia.

PROUTISTA Kirkaldy.

Proutista fritillaris (Boh.).

Three females from Uganda, Kampala (*H. Hargreaves*, 22. xii. 29); the markings on tegmina are slightly darker and more extensive than in the Sierra Leone specimens. One male and one female from Sudan. Talodi (*F. G. S. Whitfield*, 18. viii. 29), off of grass; the anal segment of the male differs from specimens from the type-locality in not being bent at right-angles and in being slightly shorter.

DIOSTROMBUS Uhler.

Diostrombus hopkinsi, sp. n.

Male.—Length 3 mm.; tegmen 6·4 mm.; wing 2·6 mm.

In build this species comes near to *D. hancocki* from Uganda, the frons being slightly more conical in outline. Three distinct but fine carinæ on mesonotum.

Shiny black; antennæ, frons, labium except apex, legs except tarsi, and genital styles yellow, posterior margin of mesonotum light brown, also the apex of anal segment. Tegmina dark fuscous or fuscous-brown, veins darker, lighter along the costal margin and over the marginal *M* cells. Wings fuscous-brown, a small hyaline spot near base, a large one along the middle of costa extending about halfway across the wing and another near apex.

Anal segment fairly long, straight, tubular, slightly expanded at apex where the anus is situated. Genital style flat, fairly thin and broad, curved, rounded at apex.

Female.—Length 2·8 mm.; tegmen 6·9 mm.; wing 3·0 mm.

In build and colour similar to male. Posterior margin of subgenital plate (7th sternite) slightly rounded and slightly projecting; styles very small; genital area yellow.

Uganda: Kampala, ix., xi., xii. 1929, nine males and three females; Kitambala, ix. 1929, two males and one female (*G. H. E. Hopkins*).

There is generally a white waxy secretion at the base of antennæ, on the lateral margin of pronotum, and on mesoscutellum. A few have the tegmina lighter. Along the outer margin of the genital styles there is a row of thin hair-like filaments, which are composed of waxy secretion and are not true hairs.

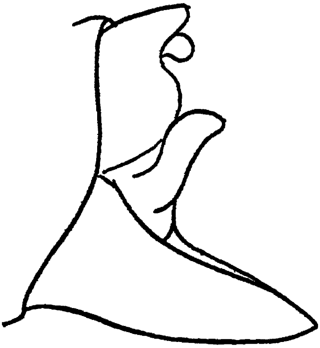
Diostrombus hancocki Muir.

One female from Uganda, Lubowa (*G. L. R. Hancock*, 6. iii. 27), which is lighter than the type-specimen from Namulala Forest; the pronotum is yellow with two pairs of black marks.

Diostrombus pseudohancocki, sp. n. (Fig. 8.)

Female.—Length 2·5 mm.; tegmen 6·9 mm.; wing 3 mm.

Fig. 8.



Diostrombus pseudohancocki, sp. n.
Lateral view of female genitalia.

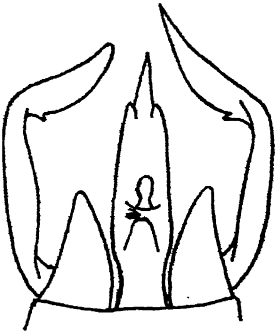
In profile frons projecting conically. The subgenital plate forming a solid, three-sided, pointed process, the dorsal surface slightly concave.

Yellow, the ventral surface and legs lighter. The apex of labium and apical joints of tarsi dark fuscous or black; a series of eight black spots on mesothorax slightly behind the pronotum, a black mark on each side of the basal angle of mesonotum extending on to the sides of mesoscutellum; black mark with lighter spots on middle of fourth and fifth abdominal tergites. Tegmina hyaline slightly yellowish, veins yellow; the costal and subcostal cells yellowish. The cross-vein between *R* and *M* dark fuscous extending to costa and much lighter back to hind margin where it fades out; a dark mark over the apical cross-vein between *Sc* and *R*, another small one at base of *R* vein near apex, and another slightly more basad; the base of each *M* sector fuscous. Wing hyaline, a light fuscous band across middle, fuscous along hind margin of apical half and over cross-vein between *M* and *R*.

One female from Uganda, Kampala (*G. H. E. Hopkins*, 2. xi. 1929).

This is close to *D. hancocki*, especially to the lighter form, but the subgenital plate is perfectly distinct.

Fig. 9.



Diostrombus whitfieldi, sp. n.
Dorsal view of male genitalia.

Diostrombus whitfieldi, sp. n. (Fig. 9.)

Male.—Length 3·3 mm.; tegmen 6·9 mm.; wing 1·9 mm.

In profile vertex and frons rounded, not produced conically. Carinæ of mesonotum fine. *M* with six sectors. Lateral margins of pygofer angularly produced. The lateral margins of anal segment broken by a small rounded projection near apex. The left genital style bent slightly beyond middle, the right with the bent portion slightly shorter and the apex more rounded than the left.

Vermilion; apex of labium, front and middle tibiæ and tarsi, hind apical tarsi, and apices of genital styles dark fuscous. Tegmina hyaline, slightly fuscous, veins brown, the *Sc*+*R* and *R* dark and thick; the costal and subcostal cells and the marginal claval cell darker fuscous. Wings fuscous, the apical half along the inner margin darkest; a small round dark mark about the middle of the anterior margin.

Female similar to male; genital styles abortive, the subgenital plate not produced.

One male and one female from Talodi, Sudan (*F. G. D. Whitfield*, 16. ix. 29), taken on grass.

This comes near to *D. grahami* (Distant), but the shape of the genital styles and the break in the margins of the anal segment distinguish it; it is also near *D. rufus* Muir, but the subgenital plate of the female is quite distinct and the male genitalia are different.

Diostrombus rufus Muir.

This was described from a female from Sierra Leone, Njala. I now have a male from the same locality (*E. Hargreaves*, 17. xi. 30); the genitalia are close to *D. whitfieldi*, but the anal segment is longer and thinner, the angular margins of the pygofer smaller, in dorsal view the genital styles broader at the base and thinner at the apex, the minute spine is basad of the bend, and there is a small projection on the outer margin near the base.

Diostrombus miniaceus, sp. n.

Female.—Length 3·3 mm.; tegmen 7·7 mm.; wing 2·4 mm.

In profile vertex and frons rounded. *M* with six sectors. Subgenital plate slightly produced and slightly bilobed on hind margin.

Vermilion; a dark fuscous mark on subgenital plate; front and middle tarsi slightly fuscous. Tegmina hyaline, slightly stramineous, veins yellow except the costa, $Sc+R$, and *R*, which are fuscous; costal cell light brown. Wings hyaline, slightly stramineous, veins yellowish, a small dark round mark about middle near costal margin.

One female from Uganda, Kampala (*G. H. E. Hopkins*, xii. 1929).

This is closely related to *whitfieldi* and *nitidus*.

Diostrombus gowdeyi Distant.

One female from Uganda, Kampala (*G. H. E. Hopkins*, 29. ix. 1929), which is quite typical. One female from

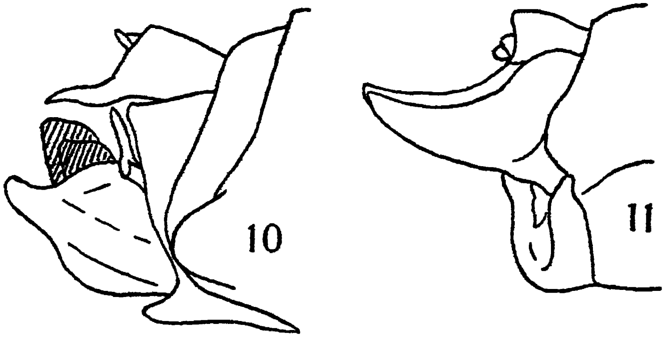
Busongoro Toro (*G. D. H. Carpenter*, xii. 1927), which may represent a distinct species, as the genital plate is only slightly produced and rounded, whereas it is typically produced into a long process slightly bilobed at apex. The general build and coloration are the same.

Diostrombus lutea (Muir).

A series of males and females from Uganda, Kampala (*G. H. E. Hopkins*, viii. 1929). Hitherto known from Sierra Leone.

Diostrombus dilatata (Westwood).

One male from Uganda, Bugoneolo (*H. Hargreaves*, 24. iv. 27). Previously known from Sierra Leone. It appears to be quite typical.



Pamendanga grahami Muir.

Fig. 10.—Lateral view of male genitalia.
Fig. 11.—Lateral view of female genitalia.

PAMENDANGA Distant.

Pamendanga grahami Muir. (Figs. 10 & 11.)

Three males and three females from Uganda, Kampala, (*G. H. E. Hopkins*, September and November 1929).

These differ slightly from the type-specimen from Ashanti, the anal angle of the pygofer being more angular, the anal segment smaller, and the process at base of outer margin of genital styles more slender. I figure the male and female genitalia from the Uganda specimens. The male genitalia of this species comes near to those of *P. hancocki* Muir (fig. 12).

Fig. 12.

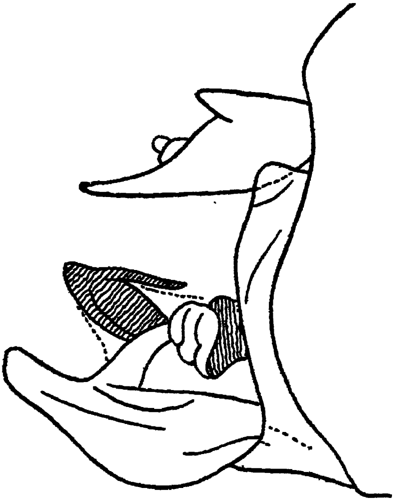


Fig. 13.

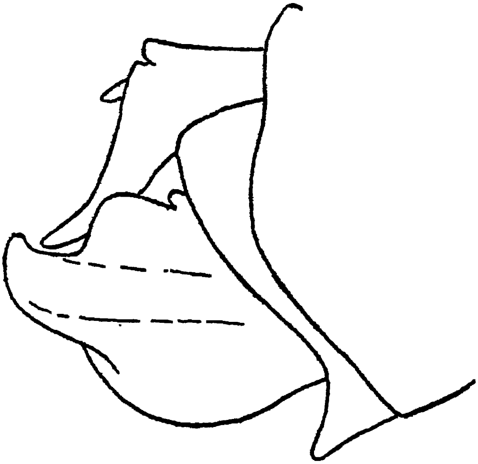


Fig. 12.—*Pamendanga hancocki* Muir. Lateral view of male genitalia.
Fig. 13.—*Pamendanga neavei*, sp. n. Lateral view of male genitalia.

Pamendanga neavei, sp. n.* (Fig. 13.)

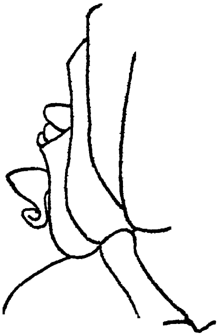
P. grahami was described from two specimens, one, the type, from Ashanti and the other from Uganda, Durro Forest (*S. A. Neave*, x. 1911). The latter differs in being larger and the male genitalia is very different. I therefore erect this species and figure the male genitalia.

Pamendanga hopkinsi, sp. n. (Fig. 14.)

Female.—Length 3 mm.; tegmen 8·4 mm.; wing 4·3 mm.

The antennæ not quite so long as frons. The seventh abdominal sternite projecting beyond the apex of abdomen, posterior margin rounded.

Fig. 14.



Pamendanga hopkinsi, sp. n.
Lateral view of female genitalia.

Light brown, the thorax slightly darker, with lighter carinæ on mesonotum. The tegmina light fuscous-brown; two hyaline bands from costal margin to hind margin, the first slightly beyond the apex of clavus, the second between the bases of the third and fourth median sectors, a small hyaline spot between the apices of median sectors and at apices of *Sc* and *R*, four small light spots in costal cell. Veins reddish, more especially the *Sc* and *R*. Wings hyaline, light fuscous over apical third and irregular at base, veins light brown.

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* The type of this species cannot, at present, be located.—W. E. C.

Hab. Uganda, Kitambala (*G. H. E. Hopkins,* 22. ix. 1929). Two females.

Delphacidæ.

Asiracinæ.

Pentagramma nigrifrons, sp. n.

Female.—Length 5·3 mm.; tegmen 5·6 mm.

Length of vertex nearly double the width; median carina obsolete. Frons longer than wide, carinæ distinct. Second segment of antennæ about three times the length of first. The mesonotal carinæ obsolete. *Sc*+*R* forking before the middle of corium, *M* and *Cu* at nodal line. The spur on hind tibiæ small, about one-third the length of basitarsus.

Brown; frons, genæ, and base of clypeus dark brown or black, apex of clypeus, two spots at apex of face, two near middle, and one on each gena light; base of vertex and between carinæ lighter brown. Pronotum, tegulæ, and middle of mesothorax lighter. Abdominal tergite dark with some yellow marks; pygofer lighter. Tegmina clear hyaline, veins light, claval veins darker brown. Front and middle legs with dark longitudinal stripes.

One female from Argentine (*H. Wilkinson*). This extends the genus considerably south, and more species are likely to be found. The present species is distinct in colour and in the narrowness of vertex.

Delphacinæ.

TROPIDOCEPHALINI.

Pseudembolophora macleayi Muir.

Four specimens, somewhat damaged; three show no trace of wings and the fourth shows the base of wings, but the tegmina are missing. We still do not know the shape of the tegmina in macropterous forms. These specimens were taken by Charles Darwin at King George's Sound, South-west Australia (1836). This genus and species was described from three specimens in the Macleay collection, Sydney, also taken at King George's Sound.

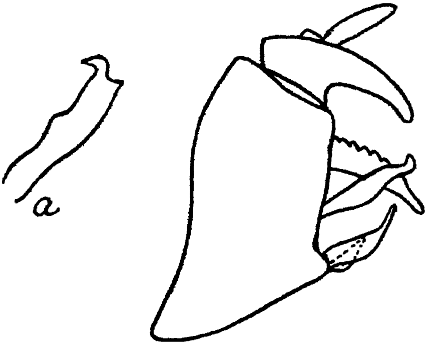
DELPHACINI.

Bostæra horvathi, sp. n. (Fig. 15.)

Male.—Length 2·3 mm.; tegmen 3·7 mm.

This species is closely allied to the two other species in this genus, *B. nasuta* Ball of America and *B. bolivari* (Mel.) of Spain. It differs from these in having the fork of the Y-vein on frons narrower and the stalk shorter; the angulation of the clypeus in profile as in *B. nasuta*; the antennæ are larger and thinner. In colour it is close to *B. bolivari*, the dark colour on apex of frons and genæ is more extensive, leaving only a narrow white band across the frons; the antennæ are all dark. The dark band at apex of tegmina is slightly more extensive, so is that over the nodal line at *Cu*, the apical vein of *R* is fuscous; the veins are the same colour as the membrane, the granules all light even in the fuscous areas. The front and middle legs with longitudinal dark lines.

Fig. 15.



Bostæra horvathi, sp. n.
Lateral view of male genitalia. *a*. Genital style.

The anal segment large with a large strong spine from each apical corner which reaches nearly across the pygofer; the opening of pygofer stirrup-shape, the ventral margin straight with two processes from the middle, one smaller than the other; the genital styles best understood from the figure.

The female is slightly larger than the male; the ovipositor slightly shorter than the pygofer; in coloration similar to the male.

Hab. S.W. Africa, Okahandja (*R. E. Turner*, March 1928), two males and one female.

RHINODELPHAX, gen. nov.

Head greatly produced in front of eyes, the vertex nearly as long as the pro- and mesonota together; width across eyes nearly as great as width of thorax. Vertex conical in outline, long, the length 3·3 times the width at base; lateral carinæ distinct, meeting together at apex where they meet the medio-frontal carina; a very short median carina at base, not extending beyond the eyes; base in front of the middle of eyes. The head flattened laterally, the genæ large; an indistinct carina from the front of the eye to near apex, where it joins the lateral frontal carina. Front long, narrow, sides subparallel except at base, where it comes to a point; median carina simple, high, especially on the basal half; lateral carinæ distinct. Clypeus tricarinate. Antennæ reaching to the base of clypeus, first segment short, longer than wide, second segment about twice the length of the first. Pronotum tricarinate, median reaching hind margin, the laterals diverging posteriorly, stopping some way before the hind margin. Mesothorax tricarinate, the laterals faint. Hind basitarsus as long as the other two together, somewhat flattened; spur large, slightly longer than basitarsus, wide, thin, with about 25 small teeth on the hind margin. Legs fairly short. Tegmina long, fairly narrow, nodal line about one-third from apex, apical margin round; *Sc+R* forking about the middle of the clavus, *Cu* rather more distad, *M* at the nodal line. Wings large, fully developed.

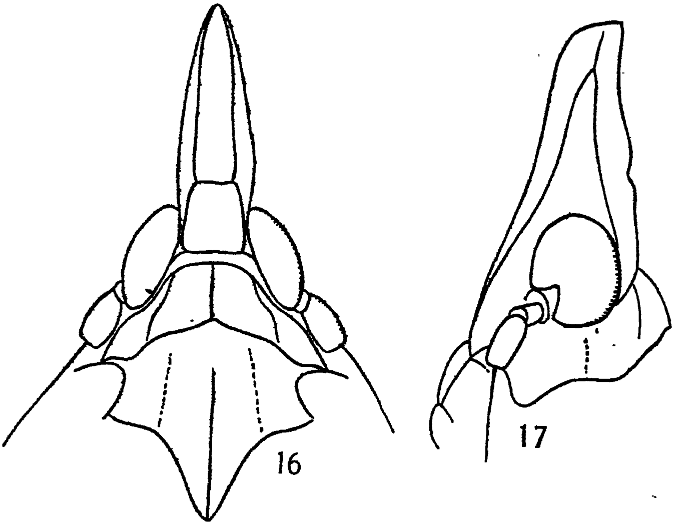
The spur places this genus in the Delphacini, and it comes between *Embolophora* and *Rhinotettix*. From the former it differs in the length of the head and it is flattened laterally; from the latter it differs in the carinæ of the head extending to the apex and in the shape of the head.

Type, *R. hargreavesi*, sp. n.

Rhinodelphax hargreavesi, sp. n. (Figs. 16 & 17.)

Macropterous Male.—Length 3·5 mm.; tegmen 3·5 mm. Fuscous-brown; tegmina fuscous-brown, slightly darker over the apical cells, the nodal line slightly lighter, veins slightly darker. Wings lighter brown with dark veins.

Female similar to male in build and colour, but inclined to be lighter. The ovipositor is short, not reaching the apex of abdomen or the apex of pygofer. The lateral plates are wide, reaching nearly halfway up the pygofer.



Rhinodelphax hargreavesi, gen. et sp. n.
Fig. 16.—Dorsal view of head and thorax.
Fig. 17.—Lateral view of same.

Hab. Sierra Leone, Newton (*E. Hargreaves*, 11. ix. 29), one male and four females.

There is a faint transverse carina on vertex, slightly beyond the eyes, which in one specimen is quite distinct.

Perkinsiella rattlei Muir.

One male and one female from New Caledonia, Bourail (*T. D. A. Cockerell*, 25. v. 1928), on sugar-cane. This was previously only known from New Guinea.

Sardia pluto Kirkaldy.

Five specimens from New Caledonia, Bourail, and Plum Farm (*T. D. A. Cockerell*, v. 1928). This is widely distributed in the South Pacific.

PLATYPAREIA, gen. nov.

Vertex shorter than wide, forming a curve with the frons, a longitudinal median carina dividing it into two small five-sided cells; base straight about the middle of the eyes. Head nearly as broad as thorax. Frons longer than wide, the median carina forking about the middle; in lateral view forming a curve with the vertex and projecting roundly towards the apex. The genæ large and wide, the diagonal carinæ meeting the laterals of clypeus. Clypeus tricarinate, broad on the sides. Antennæ reaching to about the middle of clypeus, terete, segments subequal in length. Pronotum tricarinate, the laterals divergingly curved, not reaching hind margin. Mesonotum tricarinate. Front and middle femora and tibiæ thin and expanded. Hind tibia with two spines on the side and five on the apex, three large and two small; basitarsus about as long as other two together; spur nearly as long as basitarsus, thin, tectiform, with about eighteen small teeth on hind margin. Tegmina not reaching to the apex of abdomen, semiopaque, veins obscure. This genus comes near to *Dicranotropis* by the forking of the median frontal carina, and to *Delphacodes*, but the small vertex, the long and slender antennæ, and the very broad genæ place it apart from them.

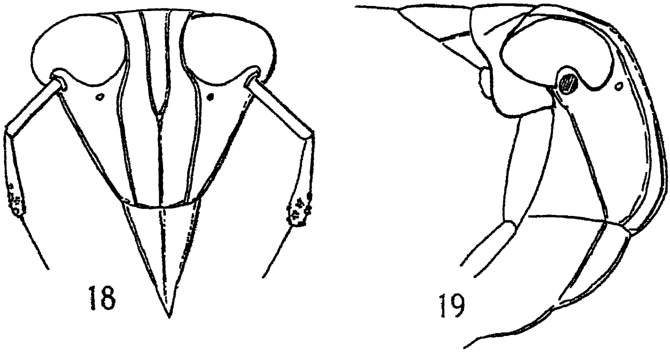
Type, *Platypareia albipes*, sp. n.

Platypareia albipes, sp. n. (Figs. 18 & 19.)

Brachypterous Male.—Length 2·5 mm.; tegmen 1·8 mm. Head dark brown, the carinæ, small spots on frons, the genæ below the diagonal carina, the sides of the base of clypeus light brown or yellowish; antennæ brown; the pronotum and mesonotum brown, carinæ and lateral portions of pronotum light; legs brown, front and middle tarsi light, hind basitarsus fuscous in middle, others light; abdomen dark with small light marks; margins of pygofer light. Tegmina not reaching to apex of abdomen, semitransparent, veins obscure, many irregular brown spots all over the tegmina most numerous on apical area. Wings absent.

Female similar to male, but slightly bigger.

One male and one female from Gopaldhara, Darjiling, 3440 to 4720 feet elevation (*H. Stevens*, 23. x. 1919).



Platypareia albipes, gen. et sp. n.

Fig. 18.—Ventral view of head.
Fig. 19.—Lateral view of same.

Delphacodes chiloensis Muir.

Two macropterous males from Chiloe Island, Chili, collected by Charles Darwin in 1834–1835, no. 2523. This was originally described from a brachypterous male from the same locality. The tegmina are hyaline, very slightly stramineous, the veins light brown, darker in the membrane than in the corium, the costal margin and commissure light, the apical margin dark. In one specimen the mesonotum is much darker than in the type.

Kinnaridæ.

Œclideus parallelus, sp. n.

Female.—Length 3 mm.; tegmen 4 mm.

This differs from the type, *nanus*, in having the apex of frons and the clypeus slightly narrower; the vertex shorter and not quite so excavate; the hind margin of the pronotum nearly straight and the carinæ of mesonotum very obscure; it is also more thick-set across the mesonotum. The costal margin is straighter and the tegmina narrower and when at rest parallel.

Black or very dark brown; the labium and antennæ lighter, carinæ of head and pronotum light brown; the surface of the pro- and mesonota very finely rugose, the carinæ of mesonotum very fine; the femora, tibiæ, and tarsi light brown. Tegmina hyaline with brown veins, the costa lighter; dark fuscous over the nodal line, widest at node and hind margin, fuscous over apical cells with the centres hyaline. Wings hyaline with dark veins.

The abdominal segments are characteristic of the family. One female from Bahia; Iguassú (*A. Roman*, August).

Type in Stockholm Museum.

Œclideus koebelei, sp. n.

Female.—Length 3·5 mm.; tegmen 5·4 mm.

Similar to *parallelus*, but somewhat stouter; the costal margins considerably curved, the tegmina broader and when at rest the costal margins not parallel; the carinæ on mesonotum very indistinct.

Vertex, base of frons, antennæ, and genæ round ocelli light reddish brown; genæ in front of antennæ and apical portion of frons light yellow or white; clypeus dark shiny brown; labium lighter brown. The hind margin and lateral margins of pronotum greenish white, the rest dark shiny brown, the lateral carinæ lighter. The mesonotum and tegulæ finely rugose, dark shiny brown or black with a metallic lustre; abdomen dark shiny brown or black; legs dark brown, hind and middle tibiæ lighter. Tegmina clear hyaline without marks; veins very fine, brown, costa and apical margin thicker and darker; wings clear hyaline; veins fine, light brown.

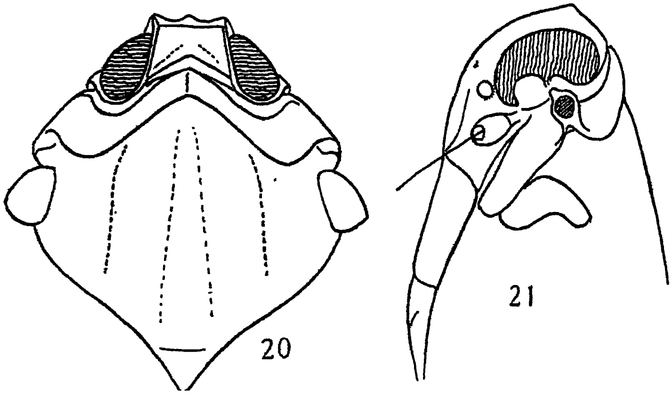
The abdominal tergites characteristic of the family, the wax-secreting areas flat and large.

One female from Mexico, Yautepec (*A. Koebele*, 1907).

Achilidæ.

BREDDINIOLA, gen. nov.

Head considerably narrower than thorax. Length of vertex along side equal to width at apex, base slightly wider than apex, angularly emarginate, apex truncate. Frons fairly narrow, base narrowest, gradually widening to apex where the sides are slightly rounded, lateral carinæ continued on clypeus; median carina distinct, continued on to clypeus where it is not so distinct. Clypeus longer than frons, suture deeply arcuate. Antennæ with second segment globose. Ocelli large. Pronotum short, especially in the middle, posterior margin deeply angularly emarginate, lateral carinæ following the outline of eyes. There is a distinctive shoulder-carina on the pronotum, from behind the eye to the tegula it is wide with a deep pit in the middle. Mesonotum wider than long, without carina. Four small spines on the side of the hind tibia, apex with an apical row of eight or nine small regular spines; basitarsus fairly long, narrow, with a regular row of small spines at apex; second tarsus fairly short with a regular row of small spines at apex.



Breddiniola tangensis, gen. et sp. n.

Fig. 20.—Dorsal view of head and thorax.
Fig. 21.—Lateral view of same.

Tegmina with a very narrow costal area not reaching to the stigma; the *Sc*, *R*, and *M* leaving the basal cell from the same spot, not forming a common stalk; *Sc* forked fairly near the base; *R* forked about level with the node; *M* forked slightly basad with four apical veins; *Cu* forking level with claval fork; clavus forking about middle of clavus, second claval vein parallel and near to commissure.

Type, *B. tangensis*, sp. n.

Breddiniola tangensis, sp. n. (Figs. 20 & 21.)

Female.—Length 8 mm.; tegmen 9 mm.

Head and pronotum light brown, darker between the carinæ and on sides of pronotum; mesonotum dark brown; tegulæ light brown; legs light brown. Abdomen dark brown, light along posterior margins of sternites. Tegmina dark brown; wings fuscous-brown.

One female from East Africa, Tanga.

Dictyophoridæ.

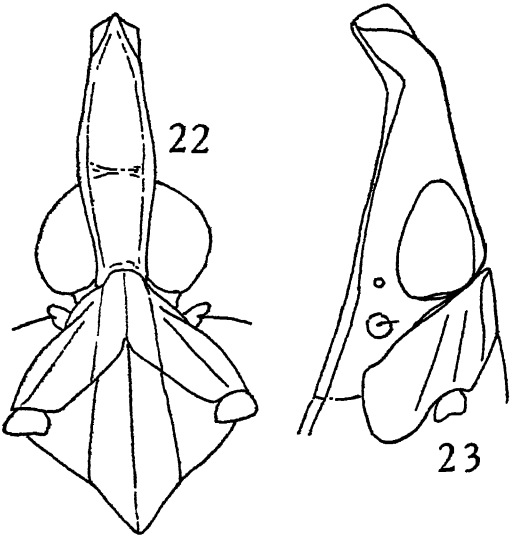
ARJUNA, gen. nov.

Head considerably produced; vertex extending more than half its length in front of eyes, gradually widened from base to slightly in front of eyes, then gradually narrowed to apex, which is pointed in the middle; the lateral margins thickened; a transverse depression at widest part which does not include the thickened lateral edges. Frons and clypeus long and narrow; the frons widest at apex, slightly constricted between eyes and narrowed at base; a distinct median carina running from base of frons to apex of clypeus; the lateral carinæ distinct on frons and clypeus except at base of frons, where they are slightly obscure and where there are signs of intermediate carinæ which fade out after the bend. In lateral view the head is bent at apex; the genæ extending to apex where the lateral carinæ of frons and vertex meet. Antennæ short, slightly longer than wide. Pronotum strongly angular both anteriorly and posteriorly, tricarinate in the middle; two shoulder-carinæ behind eyes. Mesonotum tricarinate. Legs very long and slender, simple; two to four spines on sides of hind tibiæ, apex slightly expanded with seven spines; hind basitarsus long, slightly expanded at apex where there is a simple row of small spines; second tarsus fairly large, expanded at apex where there is a simple row of small spines. Tegmina narrow; claval veins forking slightly distad of middle of clavus, entering commissure at apex. $Sc+R$ forking slightly before node, M at the same level, Cu shortly before apex of clavus; no nodal line; a few irregular cross-veins in membrane. Wings narrow, anal area reduced, hind margin straight and meeting together when at rest, the wings not folded. Both tegmina and wings projecting well beyond the apex of abdomen.

The position of this genus in the Dictyophoridæ is difficult to state. It should come into Melichar's Dictyophorini, ii., A, but it is distinct from any genus contained therein. If we place it in B it would come near to the *Scolops* group; if we consider its hyaline tegmina then it would come into the *Eudictya* group or a derivative of *Dictyophora*.

I hesitated to describe this as a new genus, as such a widely distributed and striking little insect I thought must be described, but I have failed to identify it with any published description.

Type, *A. dohertyi*, sp. n.



Arjuna dohertyi, gen. et sp. n.
Fig. 22.—Dorsal view of head and thorax.
Fig. 23.—Lateral view of same.

Arjuna dohertyi, sp. n. (Figs. 22 & 23.)

Male.—Length 6 mm.; tegmen 5·2 mm.

Head greenish, genæ in front of eyes and the middle of frons and clypeus red; pronotum green, red over the lateral areas ; mesonotum greenish with a slight red tint ; pleura green with reddish marks ; abdomen green. Front and middle femora dark brown with a thin light longitudinal line ; hind femora light brown ; tibiæ and tarsi brown. Tegmina hyaline with greenish or yellowish veins ; granules on veins very small, bearing small black hairs. Wings hyaline with yellowish veins which bear black hairs on the ventral surface.

Described from four specimens, one male from Arjuna, Java, one male and one female from Ende, Flores, and a female from Humboldt Bay, New Guinea (*W. Doherty*, 1903). The description is from the Java specimen, in the others the red is more extensive and in the two females supplants the green.

Hasta lineata, sp. n.

Male.—Length 11·6 mm. ; head 3·9 mm. ; tegmen 8·5 mm.

The produced head fairly wide, twice the length of pro- and mesonota together. The genæ visible in dorsal view ; a fine median carina runs the length of the vertex ; on the frons the median carina confined to the apical portion, where it continues on to the clypeus ; the medio-lateral carinæ distinct from base to apex, nearest together at apex gradually widening apart towards the base ; the lateral carinæ distinct in frontal view at apex, but gradually taking a position at the sides, causing the middle portion of the frons to stand out on the basal half ; the lateral carinæ of frons continued on to the clypeus. Front tibiæ considerably longer than the femora, one hind tibia with 5, the other with 6 spines ; the lateral margins of pronotum curved ; there are three carinæ on shoulder, two reaching the hind margin and one (the outer) only reaching halfway. The stigma long with four cells.

Greyish brown ; lighter over clypeus and apex of frons, darker on genæ around antennæ and ocelli ; carinæ of thorax and the median one on vertex light ; all the legs with longitudinal, thin, dark brown stripes, labium also with light brown mark down the dorsal surface. Abdominal sternites brown, darker on outer thirds, with light dots. Tegmina clear hyaline, veins brown or greenish brown, darkest on membrane where the dark cross-veins spread slightly into the cells; stigma dark.

Hab. Africa, Hinterland, Ivory Coast, Bouaké. One male.

Hasta pallidinervis, sp. n.

Male.—Length 9·5 mm.; head 3·8 mm.; tegmen 7·7 mm.

Head twice the length of pro- and mesonota together, straight but slightly more ascending; the vertex narrower, the median carina confined to the basal portion between the eyes, very fine; the median carina of frons distinct from base to apex; front tibiæ very slightly longer than the femora. Hind tibiæ with four spines, on one leg three confined to apical half, in the other subequal distances apart. Stigma long with fine cells.

Light pinkish brown, carinæ of head and thorax lighter, the middle of frons yellowish; the hind legs and abdomen inclined to yellow, the front and middle legs with faint longitudinal markings. Tegmina clear hyaline, very slightly yellowish over hind and apical margins; veins all light.

Hab. S.W. Africa, Okahandja (*R. E. Turner*, March 1928), one male.

Hasta viridis, sp. n.

Male.—Length 9·6 mm.; head 3·8 mm.; tegmen 7·7 mm.

Head double the length of pro- and mesonota together. In build similar to *H. pallidinervis*. The median carina of vertex confined to base between eyes; the median carina of frons distinct from base to apex; front tibiæ slightly longer than femora.

Light green; frons in middle lighter; carinæ of thorax greenish; faint fuscous lines on front and middle femora. Tegmina and wings clear hyaline, veins green; stigma clear consisting of three cells.

Hab. S.W. Africa, Okahandja (*R. E. Turner*, March 1928); one male.

Hasta ogadensis Mel.

One damaged male, which appears to be this species, from Bahr el Ghazel (*V. H. Furgusson*, 7. ix. 23; no. 20246).

LIX.—*Notes on Four Cestodes.* By H. A. Baylis, M.A., D.Sc., Department of Zoology, British Museum (Natural History).

1. *Moniezia mettami*, sp. n.

A collection of parasitic worms from Uganda, kindly forwarded to the writer for determination by Mr. R. W. M. Mettam, M.R.C.V.S., of the Veterinary Laboratory, Entebbe, included two specimens of a Cestode from a wart-hog (*Phacochœrus æthiopicus*). Up to the present the only adult Cestode known from this host appears to be *Paramoniezia phacochœri* Baylis, 1927. The present specimens differ from this species in a number of characters, and are provisionally regarded as representing a new species of the genus *Moniezia*. They bear a very close resemblance to *Moniezia benedeni* (Moniez, 1879), but appear to differ from it in certain small points which will be mentioned below.

The larger of the two specimens available, measured in formalin, gave a length of about 22 cm. and a maximum width of 11 mm. The scolex, measured in creosote, had a latero-lateral diameter of about 0·85 mm., and the suckers, which are circular, a diameter of about 0·3 mm. The apertures of the suckers are longitudinal slits. Segmentation becomes apparent at a distance of about 2·3 mm. from the anterior extremity. The unsegmented "neck" measures about 0·6 mm. in width at its narrowest part. All the segments are much wider than long.

The usual thin layers of subcuticular muscles are present. The glandular layer below these is much vacuolated. In spite of careful examination of stained whole preparations and numerous serial sections, no definite interproglottidal glands could be detected. The main longitudinal musculature occupies about half the thickness of the cortical parenchyme, and does not appear to be clearly differentiated into two layers of bundles. The transverse layer, situated internally to the longitudinal muscles, is thin. Some dorso-ventral muscle-fibres are present, particularly in the medullary portion of the parenchyme. Both dorsal and ventral longitudinal excretory canals are present. The latter are wide and are connected by transverse intersegmental vessels, but not branched. The dorsal canals are narrow and are situated on the inner side of the ventral canals. The longitudinal nerves are in close connection with the ventral canals on the outer side.

Each segment has two sets of female organs and two genital pores. The male and female genital ducts pass dorsally to the lateral excretory canals and nerve. The vagina, which lies slightly posteriorly to the cirrus-sac, always opens ventrally to it on the right side, and apparently always dorsally to it on the left. In this respect, therefore, the species is a typical *Moniezia*. The genital atrium measures about 0·1–0·15 mm. in depth. The cirrus-sac, which is somewhat pyriform or flask-shaped, having a swollen proximal end and a narrow distal portion, almost reaches the ventral excretory canal. It measures 0·25–0·27 mm. in length and 0·08–0·09 mm. in maximum width. The cirrus is feebly developed and apparently unarmed. In the swollen portion of the cirrus-sac it has a muscular swelling, which possibly represents an internal seminal vesicle. The vas deferens is much coiled and greatly distended with sperm in mature segments, but there is no special external seminal vesicle. The number of testes is estimated as not less than 400 in each segment. They are arranged in from two to three layers dorso-ventrally and from four to five layers antero-posteriorly, and extend in an unbroken field between the two groups of female glands, while a few are also found between these and the lateral excretory canals.

The vagina pursues a conspicuously tortuous course from its opening into the atrium as far as the ovary, and widens gradually all the way to its proximal end. Here it appears to be suddenly constricted and connected by a narrow duct with a large, elongate, thin-walled receptaculum seminis. This connection, however, seems to be lost soon after impregnation. The vagina has a thin muscular wall, covered externally with a thick coat of cells which stain deeply with hæmatoxylin. It is apparently not ciliated internally. Immediately before entering the atrium it has a very rudimentary sphincter. At about the middle of its course, where it crosses the ventral excretory canal, its outer diameter (including the cellular coat) is about 0·07–0·08 mm. At its proximal end it attains a diameter of about

0·1–0·11 mm., and its lumen here has a width of about 0·06–0·07 mm. The distance, in a straight line, from end to end of the vagina is about 0·9 mm. The ovaries, vitelline glands, and shell-glands present no remarkable features. The uterus is at first a network of tubes forming a complete layer in the external portion of the medulla, immediately within the transverse musculature. Extensions of this network pass beyond the lateral excretory canals on the dorsal side, but not ventrally. In fully gravid segments the uterus appears as a lobulated sac completely filling the medulla. The eggs are of the form usual in *Moniezia*, and are almost exactly similar to those of *M. benedeni.* The diameter of the outer shell is 0·066–0·08 mm. The pyriform apparatus is typical, its horns ending in a cap. The diameter of its spherical portion, containing the onchosphere, is 0·02–0·022 mm.

In attempting to arrive at a determination of this species, three known forms were specially considered :—

(1) As has been stated, it bears a very close resemblance to *Moniezia benedeni.* The apparent absence of interproglottidal glands is not a satisfactory diagnostic character, since these glands are often very difficult to detect, or may even be absent, in *M. benedeni* (see Theiler, 1924; Taylor, 1928). But the character of the vagina appears to be different in the two forms. In the specimens of *M. benedeni* examined by the writer this organ is much less conspicuous, nearly straight, and much narrower than in the material from the wart-hog, expanding rather suddenly at its proximal end to an outside diameter of about 0·06–0·09 mm., and having a width in the middle of not more than about 0·05 mm. It also has a very well-developed sphincter at its opening into the atrium.

(2) In *Moniezia pallida* Mönnig, 1926, a form recorded from the horse in South Africa, the interproglottidal glands are said to be linear (*i. e.*, of the type seen in *M. benedeni*), but indistinct. Branches of the uterus extend beyond the longitudinal excretory canals not only dorsally but also sometimes ventrally—a character which has been confirmed by Taylor (1928). The eggs, unfortunately, are not described, and several other details are omitted from the description, so that a complete comparison is impossible.

(3) *Fuhrmannella transvaalensis* Baer, 1925 (*b*), from the cane-rat, *Thryonomys swinderianus*, in South Africa, is described as having an unusual arrangement of the uterus, which forms a network continuous dorsally, anteriorly, and ventrally, but interrupted posteriorly. Branches of the uterus also extend into the cortical parenchyme. The relationship of the cirrus-sac and vagina (the latter is described as "posterior" to the former) and the number of testes (200) appear to be characters in which the parasite differs from that of the wart-hog. It seems to the writer, however, very doubtful whether the genus *Fuhrmannella* can be regarded as distinct from *Moniezia*. It even seems possible that further investigation might show that this form and *M. pallida* were in reality variations of *M. benedeni*.

Although the form from the wart-hog possesses some of the characters of all three of these species, it appears impossible at present to identify it with any of them, and it is accordingly treated provisionally as a new species. The type-material is in the British Museum (Natural History).

2. *Raillietina* (*Paroniella*) *woodlandi*, sp. n.

Mr. Mettam's collection from Uganda also contained some Cestodes from a guinea-fowl. These included—besides *Cotugnia digonopora* (Pasquale, 1890), *Octopetalum longicirrosum* Baer, 1925, and *Raillietina* (*Paroniella*) *numida* (Fuhrmann, 1912)—two specimens of a form which appears to be identical with the "Cestode with an armed scolex" described by Woodland (1928) from *Numida ptilorhyncha* in the Sudan. The writer is greatly indebted to Dr. Woodland for kindly lending his original preparations of this worm for comparison, and has much pleasure in naming the species after him.

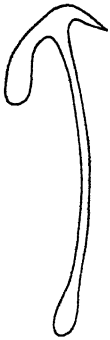
Woodland had only fragments of the worm at his disposal, and these included no gravid segments. He was therefore unable to give a complete description, and was in considerable doubt as to the systematic position of the species. In a later paper (1930), however, he expressed the view that it belonged either to *Raillietina* or to *Ophryocotyloides*. On the evidence of the present material it is possible to state definitely that the worm belongs to the genus *Raillietina* and to the subgenus *Paroniella*.

Woodland estimated the total length as at least 50 mm., and found a maximum width of 3·7 mm. in the immature region of the strobila. In the present collection an apparently complete specimen (rather contracted) measures about 27 cm. in length, and the maximum width (in the mature region) is about 6·5 mm. In this specimen, after being mounted in balsam, the scolex has a diameter of about 0·7 mm., the suckers of 0·16–0·17 mm., and the rostellum of about 0·27 mm. The scolex of the other specimen, which was measured in creosote, gave slightly larger dimensions (diameter of scolex 0·82 mm.; of suckers 0·17–0·19 mm.; of rostellum about 0·3 mm.). The measurements given by Woodland were 0·81 mm. for the diameter of the scolex, 0·166 mm. for that of the suckers, and 0·23 mm. for that of the rostellum. The suckers are, as in Woodland's material, deeply retracted within the scolex and communicate with the exterior by tubular channels. If they were ever armed, their spines appear to have been completely lost.

According to Woodland, the rostellum carries "a circle" of hooks, approximately 60 μ long, and these were estimated to be about 80 in number. The shape of the hooks, as indicated in his figure, was subsequently (1930) admitted to have been incorrect, the "prong" or shorter root of the hook having been omitted. In the writer's material it is seen that the rostellum bears not a single crown of 80 hooks, but roughly three such crowns overlapping each other, so that the total number of hooks can scarcely be less than 240. Even in a frontal view of the scolex, however, so closely are the hooks crowded together that it has not been possible to count them with any accuracy. The same overlapping arrangement of the hooks has been observed in Dr. Woodland's original preparations. The length of the hooks appears to be from about 54 to 66 μ, those of the most anterior crown being the longest. It has not been found possible to obtain a camera-lucida drawing of an isolated hook, but some idea of the shape of the hooks may be gathered from the accompanying freehand sketch (p. 592). They have a very long "ventral" root, ending in a swelling which appears to be stained to some extent by hæmatoxylin in Dr. Woodland's preparations. The "dorsal" root is longer than the blade, and is rather broadly rounded.

As regards the anatomy of the mature segments the writer has little to add to Dr. Woodland's account. The genital pores appear, in the present material, to be quite regularly unilateral, although Woodland observed some irregularities in this respect. The longitudinal musculature is very highly developed, and takes up the greater part of the thickness of the cortex, the bundles of fibres gradually decreasing in size from the innermost to the outermost. The writer has failed, as did Woodland, to find any dorsal excretory canals. The ventral canals and their transverse connections are very wide.

The shape of the cirrus-sac appears to vary considerably. Sometimes, as described by Woodland, it is narrow for about the distal two-thirds of its length, and has a bulbous expansion about 0·05 mm. wide at its proximal end. At other times the sac appears cylindrical or fusiform, or its widest part may even be at the distal end. These variations are probably connected with the degree of protrusion of the cirrus. The length of the sac is usually about 0·2 mm., but occasionally as much as 0·24 mm. The vas deferens is considerably coiled, but there appears to be no special seminal vesicle. Woodland estimated the number of testes in each segment to be over 100. Judging from horizontal and transverse sections, there are probably not less than 150 testes. These, as Woodland states, extend from the ovary to the lateral canal of the opposite side. They are, however, arranged for the most part in a single layer dorso-ventrally, so that



Raillietina (Paroniella) woodlandi. Hook from rostellum.

in a transverse section they appear as a single row, and not as two or three rows, as indicated in Woodland's figure (1928, pl. xviii. fig. 16). The testes are usually somewhat elongated dorso-ventrally.

The vagina runs quite straight from its opening behind the cirrus-sac to the centre of the female gland-complex. Woodland states that it shows no marked dilatation. On the inner side of the lateral excretory canal, however, the duct gradually expands into an elongate, fusiform, thin-walled receptaculum seminis, which retains this shape even in the gravid segments. The ovary is of the usual multilobate form and is situated on the extreme poral side of the medulla. The vitelline gland, which has few lobes, occupies a rather unusual and characteristic position on the aporal side of the ovary. The shell-gland lies between the ovary and vitelline gland and towards the dorsal side.

The uterus appears quite early as an irregular network of spaces permeating the medulla. Ultimately, in the gravid segments, the eggs become enclosed, for the most part singly, in separate cavities in the parenchyme. These cavities have very thin walls, and scarcely merit the term "capsules." Exceptionally two or more eggs may be seen in a single cavity, but the dense parenchymatous capsules characteristic of the subgenus *Raillietina* are not developed. The onchospheres have a diameter of 32–40 μ, and the embryonic hooks measure 18–20 μ in length.

The type-material of this species is in the British Museum (Natural History).

3. "*Davainea tetragona* (Molin) var. *lagopodis*" Baylis, 1919.

This form was described from *Lagopus muticus* in Arctic Russia. At the time Fuhrmann's (1920) reclassification of the old genus *Davainea* had not appeared, and sufficient attention was not given to the condition of the egg-capsules. On re-examining the original material the writer finds that in gravid segments the eggs are enclosed singly in cavities in the parenchyme. The worm therefore belongs to the subgenus *Paroniella*, and cannot be a variety of *Raillietina* (*R.*) *tetragona*. In spite of slight differences, chiefly in measurements, from the typical form, it is in all probability a synonym of *Raillietina*

(*Paroniella*) *urogalli* (Modeer, 1790), of which a good description has been given by Fuhrmann (1919).

4. *Unciunia sudanea* Woodland, 1928.

Of this species, recorded from *Numida ptilorhyncha*, the writer has, through Dr. Woodland's kindness, been enabled to examine the original material, and believes it to be identical with *Octopetalum longicirrosum* Baer 1925 (*a*). The characteristic lappets on the edges of the suckers (which are much less well developed in this species than in the genotype, *O. gutteræ* Baylis, 1914) are not easy to observe in Dr. Woodland's material, owing to its contracted condition, but can be seen in one or two of the more favourable specimens. The paruterine organ, which was not mentioned in Dr. Woodland's description, is also present, and the very long cirrus-sac corresponds exactly with that of *O. longicirrosum*. On the other hand, as Woodland states, the hairs and single chitinous spine described as characteristic of the cirrus in the genus *Unciunia* Skrjabin, 1914, cannot be detected. The name *Unciunia sudanea* must therefore be regarded as a synonym of *Octopetalum longicirrosum*.

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LX.—*Description of a Species of the Filariid Genus* Litomosoides *from* Glossophaga soricina (*Cheiroptera*).

By J. H. Sandground, Department of Tropical Medicine and Museum of Comparative Zoology, Harvard University.

The genus *Litomosoides* Chandler, 1931, was created to accommodate a filariid nematode, *L. sigmodontis*, occurring commonly in the so-called cotton-rat, *Sigmodon hispidus*, in Texas. In 1932, Vogel and Gabaldon published, under the new generic name *Vestibulosetaria*, a description of a worm found in the pleural cavity and pericardium of *Rattus norvegicus* (*Mus decumanus*) in Caracas, which in 1928 had been recorded from *Holochilus vulpinus* by Mazza under the taxonomically unacceptable name "*Filaria*" *patersoni*. The same worm as was involved in the above-mentioned papers was again described as *Micropleura sigmodoni* in Mexico by Ochotorena and Caballeros (1932). As recently indicated by Chitwood (1933), *Vestibulosetaria* is a synonym of *Litomosoides*, whose type-species by reasons of priority now carries the name *L. patersoni*.

Aside from the relative position of the vulva that is at most a character of specific consequence, the essential differences between the genera *Litomosa* and *Litomosoides* are concerned with the shape of the buccal vestibule and the presence or apparent absence of post-anal papillæ in the male. In distinguishing his genus, Chandler also attributed significance to the fact that the extremity of the tail of the female *Litomosa filaria* (at that time the only species in the genus adequately described) was provided with digitiform processes in contrast to their absence in the type-species of *Litomosoides*. In so far as the recently described *Litomosa americana* M'Intosh, 1933, does not possess these caudal processes, the character is seen to be specific rather than generic.

Again, the statement made in the generic diagnoses of both *Litomosa* and *Litomosoides* that cephalic papillæ are absent is not acceptable for these structures, even though they may be greatly reduced in size are in all probability universally present among nematodes, both free-living and parasitic. At any rate, a ring of four cephalic papillæ together with the usual lateral amphids have been described in the various species of *Litomosoides* where proper study has been made and they have been found in at least one species of *Litomosa*—namely, *L. wite* Krepkogorskaja, 1933. The same hesitancy may, perhaps, be exhibited towards accepting the statement that there are no caudal papillæ on the males of species of *Litomosa*. In *Litomosoides* the caudal papillæ are exceedingly small and easily escape observation (cf. *L. guiterasi*).

The chief distinction that remains between the genera *Litomosa* Yorke & Maplestone, 1926, and *Litomosoides* consists in the shape of the buccal vestibule. In *Litomosa* it is funnel-shaped, with the apex directed posteriorly in some species, anteriorly in others; in *Litomosoides* the buccal vestibule is regularly cylindrical with uneven thickenings of its walls.

The character is a significant one, for it is not subject to variation, but to differentiate a nematode genus from a closely related one on a single character is an unorthodox procedure among taxonomists, and is especially undesirable where the number of species that constitute the related genera is not so large as to merit the introduction of new names simply to subserve the pragmatic purpose of facilitating identification. Under such a condition, the extension of the original generic definition meets most practical requirements and avoids overburdening the literature with new names. In the present instance, however, the fact that *Litomosoides patersoni* has come to represent a natural type, around which at least three new species (including one here described) have been grouped, would seem to justify its being given some superspecific differentiation.

The following species are now to be included in the genus:—

L. patersoni (Mazza, 1928)—from rodents (*Sigmodon* sp., *Rattus* sp.).

L. circularis (v. Linstow, 1899)—from rodents.

L. guiterasi * (Vigueras, 1934)—from a bat.

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* This species was recorded under the new generic name *Finlaynema*. Specimens which the writer had received from Vigueras, the author of the species, enable us to designate its proper taxonomic status and also to amplify its description in certain features. In our single male specimen of *Litomosoides guiterasi* the spicules measure ca. 200 μ and 60 μ; postanal region is not devoid of caudal papillas, but carries three or, perhaps, even four pairs of very minute papillæ.

Genus LITOMOSOIDES Chandler, 1931.

Litomosoides hamletti, sp. n. (Figs. 1–4 *a*.)

Host.—*Glossophaga soricina soricina.*

Location.—Abdominal cavity.

Locality.—Arapuá, Matto Grosso, Brazil.

Our material consists of 5 females and 2 males taken from two specimens of the host by Dr. G. W. D. Hamlett in December 1933. The dimensions of the various organs are tabulated below. These measurements, together with camera-lucida drawings of the buccal vestibule and the tails of the male and female should suffice for the recognition of the species, making a formal description of its morphology redundant.

Dimensions (based on 2 specimens of each sex) :—

	Male.	Female.
Length (mm.)	15–16·5	35–51
Maximum width (mm.)	0·10–0·11	0·17
Length of oral vestibule	19·4 μ	21 μ
,, œsophagus (mm.)	0·45–0·59	0·69–0·78
Nerve-ring from head (mm.)	0·09	0·14
Anus to posterior end (mm.)	0·057	0·101
Spicules right	82–90 μ	....
Spicules left	220–280 μ	....
Vulva from head	....	0·40–0·45

Viviparous—larvæ not measured.

Differential Diagnosis.

		L. patersoni.	*L. circularis.*	*L. guiterasi.*	*L. hamletti.*
Length (in mm.)	female	50–114	65	24	35–51
	male	24–28	20	8	15–16·5
Length of tail (in microns)	female	500–1080	690	..	100
	male	150–220	160	90	57
Length of spicules (in microns)	left	185–360	260	200	220–280
	right	78–105	190[*]	60	82–90
Position of vulva relative to end of œsophagus		Markedly posterior.	Markedly posterior.	Same level.	Markedly anterior.
Pairs of caudal papillæ in male		4	7	3 or ?4	2

In the above table we have assembled the chief criteria for the comparison of the four species in the genus. The data relating to *L. patersoni* have been assembled from the description of what purports to be the same species provided by Chandler and by Vogel and Gabaldon. From this one derives a fairly good idea of the extent to which

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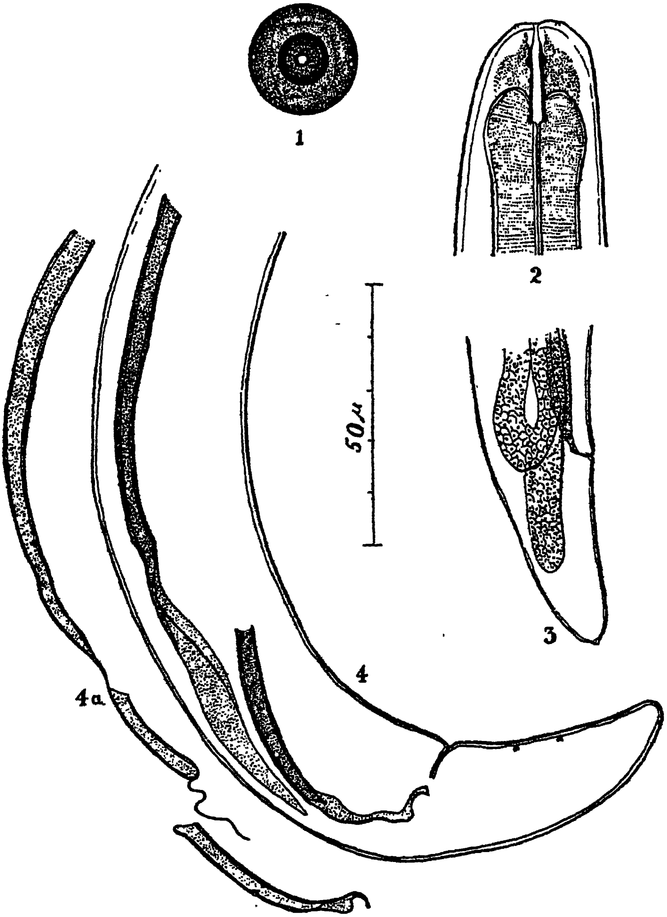
[*] This figure is not in accord with v. Linstow's diagram; it is



Litomosoides hamletti, sp. n.

Fig. 1.—Head in *en face* view (free-hand sketch), showing circular mouth aperture, four minute cephalic papillæ in median positions, and lateral amphids.

Fig. 2.—Anterior extremity, showing characteristic shape of oral vestibule.

Fig. 3.—Posterior extremity of female (note a slightly button-shaped thickening at extremity).

Fig. 4.—Posterior extremity of male.

Fig. 4 *a*.—Spicules of *L. guiterasi*.

The scale applies to figs. 2, 3, 4, & 4 *a*.

intraspecific variation may be exhibited. Consequently the creation of new species on commensural considerations is to be undertaken with circumspection, bearing in mind that relatively small differences in the size or position of an organ may be vitiated when a sufficiently large supply of material is available. Our table indicates how tenuous must be any specific differentiation that is attempted on the basis of measurements alone, since intergrading is to be expected in most criteria.

The species *L. hamletti* is only provisionally suggested as new. It is obviously closely related to *L. guiterasi*, from which it is presumptively distinguished on the basis of the number of caudal papillæ in the male and the position of the vulva (near the middle of the œsophagus). So far as is shown by the limited material at our disposal, *L. hamletti* is also to be distinguished from *L. guiterasi* by the shape of the distal ends of the two spicules (compare figs. 4 & 4 *a*) and by the peculiar type of thickenings on the walls of the buccal vestibule (fig. 2), which appears to be constant for the various species.

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LXI.—*Some Insects from the Scoresby Sound Region, East Greenland, with an Account of the Fauna of a Nunatak.*

By DAVID LACK, B.A.

THE following collection was made in August 1933 while I was a member of the Cambridge expedition to Scoresby Sound, in lat. 70° N., of which B. B. Roberts is publishing an account in the 'Geographical Journal.' The main collection was made round Hurry Inlet, a subsidiary fjord running northward from Scoresby Sound, between August 1 and 15. Most were taken in Jameson Land, on the west side of the inlet, others in Liverpool Land on the east. In addition, a small collection was made round the Eskimo settlement at Rosenvingen Bay on August 18, and another further south at Cape Dalton on August 20.

I wish to record my indebtedness to Dr. J. B. Charcot, who gave the expedition a passage to Scoresby Sound, and to all the scientists, officers, and crew of 'Pourquoi Pas?' for their continual help and kindness. A species of moth hitherto undescribed has been named after Dr. Charcot. I must also thank G. C. L. Bertram and B. B. Roberts, my two companions, for their great assistance in the field, and the various specialists who have identified the insects brought back. Most of the collection has been presented to the British Museum (Natural History).

All the main groups of insects were collected except the Anoplura, Mallophaga, and Aphaniptera, but very little time was given to the Collembola. Spiders were also collected. So short was the stay that the collection cannot be considered representative of the region visited, and many forms which emerge only earlier in the summer must have been passed over. A typical set of the insects was collected so that their ability to withstand low temperatures might be studied. The results of this investigation are being published separately by Bertram*, who is hoping to correlate the minimum temperature at which the insects are active with their distribution in the Arctic.

The problem of whether animal life survived the glacial epoch in Greenland and other Arctic countries, or whether all life has colonised since that time (by the air and other means), has long been disputed. It was thought that the presence or absence of life on a nunatak, which represents the severest conditions of ice-free land in the Arctic, might throw light on this point. It is usually maintained that, however severe the glaciation, there would always be some land free of ice and snow, perhaps the tops of the mountains and perhaps a coastal belt. Mr. N. E. Odell, a member of Miss Boyd's expedition 1933, informs me that erratics have been found on a number of the highest mountain summits in the Franz Joseph Fjord area, indicating that the mountains of East Greenland, at least in this area, were completely submerged during the glacial period. On the other hand, in Iceland there is evidence that the glaciation reached only a certain height on the mountains, the rest presumably projecting as nunataks. It therefore seems probable that any forms found on a nunatak would have been able to survive the glaciation, at least in Iceland. For these forms there would be no need to suppose a subsequent colonisation by air or other means.

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* In 'Journal of Animal Ecology.'

On August 9, Bertram, Roberts, and I crossed to the east side of Hurry Inlet, and then climbed to and crossed the small ice-cap in the centre of Liverpoool Land, to a peak about 3000 feet high overlooking the Liverpool Coast. This peak was completely surrounded by ice, having some five miles of ice-cap to the west and big glaciers on the other three sides. At the time of our visit, 12 P.M., the temperature was below freezing-point. We found a patchy vegetation of both Cryptogams and Phanerogams with a small amount of soil. Samples of this were taken back to the camp, where they were analysed carefully by means of a Berlese funnel. Three animal groups were represented as follows :—

COLLEMBOLA.—*Folsomia fimetaria* (L.), many.
Isotoma cinerea (Nic.), several.
Isotoma sensibilis Tulb., many.

All the above are very widely distributed species.

DIPTERA : CHIRONOMIDÆ.—Five larvæ of the subgenus *Smittia* of *Spaniotoma* (sometimes known as *Camptocladius* or *Phænocladius*). Dr. F. W. Edwards, who identified these specimens, adds that this is a widely distributed genus whose larvæ are commonly found at the roots of grasses and moss.

ARACHNIDA.—One very young *pullus* of the subfamily Erigoninæ of the Linyphiidæ, perhaps in the genus *Erigone* itself. A. R. Jackson, who identified the specimen so far as this was possible considering its age, remarks that it may have arrived on the nunatak by an aerial current and need not have resided there for any length of time. However, it may be noted that Bertram's experiments showed that most spiders remained active at temperatures just below freezing-point, so that it seems possible that spiders could exist on the nunatak. Hence the three species of Collembola and the Chironomid, and possibly the spider, could presumably survive a glaciation provided that some land remained free of ice.

The following list includes all the orders of insects collected except the Diptera, which are not yet identified. A. Roman's account of the Ichneumonidæ and A. R. Jackson's account of the spiders will be found as separate papers consecutive to this one. The present collection emphasises the poorness of the insect fauna of East Greenland as compared with the West. Henriksen and Lundbeck (1918) have summarised the data on Greenland insects. Rémy (1928) has added further data for the east coast. In the following list one species of Lepidoptera is new to science, four species of Collembola, one Aphid, and one other species of Lepidoptera have not previously been recorded from Greenland, and two other species of Lepidoptera are new for East Greenland, but have previously been recorded from West Greenland. All the other species have been recorded before from East Greenland :—

Order COLLEMBOLA
(determined by Rev. Dr. G. H. Carpenter).

No special search was made for the species of this group, save in the investigation of the fauna of the nunatak. Actually most of the region investigated was unsuitable for these forms. They were not nearly so conspicuous an element in the fauna as, for instance, I found them on Bear Island, in the Barents Sea, in lat. 74° N., perhaps correlated with the comparative scarcity of moss and the much drier climate in Greenland. Rémy (1928) has given a list of the Greenland Collembola, of which twenty species have been found on the east coast. Eight species were recorded by me, of which four do not feature on Rémy's list and are new for Greenland. These four, which are asterisked in the list below, are all widely distributed forms.

Poduridæ.

**Onychiurus pseudarmatus* Folsom. 1, Point Constable, Hurry Inlet.

Entomobriidæ.

Folsomia fimetaria (L.). Many, Liverpool Land nunatak.

Folsomia sexoculata (Tulb.). 3, Point Constable.

**Isotoma cinerea* (Nic.). 1, Point Constable, several Liverpool Land nunatak.

Isotoma sensibilis Tulb. Many, Liverpool Land nunatak.

Isotoma viridis Bourlet. 1, Cape Dalton.

Sminthuridæ.

**Sminthurinus niger* (Lubb.). 1, Point Constable.

**Sminthurinus viridis* (L.). 3, Jameson Land.

Order THYSANOPTERA

(determined by F. Laing).

Physothrips sp., either *vulgatissimus* (Halid.) or very closely allied. 2, Jameson Land.

The specimens were in too poor condition to be identified. *P. vulgatissimus* has been recorded before from Greenland.

Order HEMIPTERA.

HETEROPTERA (determined by W. E. China).

Nysius grœnlandicus Zett. 1, Jameson Land.

Chlamydatus pulicarius Fall. 2, Jameson Land.

These are the only two species of the order known from East Greenland.

HOMOPTERA (determined by F. Laing).

Aphididæ.

Melanoxantherium sp. 1 winged male, Cape Dalton.

Mr. Laing writes that there is a good deal of confusion among the species of this genus. The above specimen is not a European species, and, judging from descriptions, it is allied to *M. media* (Baker) found in Connecticut. *M. populifolia* (Fitch) is apparently the only member of the genus found far north, in Popoff I., Alaska. The genus has not previously been recorded from Greenland.

Order TRICHOPTERA

(determined by M. E. Mosely).

Apatania arctica Boheman. Many, Liverpool Land.

The specimens included a male, which is rare and was formerly considered a different species *A. palméni* Sahlberg;

see Lack (1933) for the capture of a pair *in coitu* on Bear Island, and for the references to the literature on this point. *A. arctica* is the only species of the order known from East Greenland, though several others occur on the west coast.

Order LEPIDOPTERA.

BUTTERFLIES (determined by N. D. Riley).

Colias hecla Lefeb. 2 males, 1 female, Jameson Land.

Argynnis chariclea var. *arctica* Zett. 6 males, 3 females, Jameson Land.

Cupido orbitulus franklini Curtis. 1, Jameson Land.

The above three species, and also one other, *Argynnis polaris* Boisduval, have been previously recorded from East Greenland.

MOTHS (determined by W. H. Tams, save for the *Phthorimœa* by E. Meyrick).

Laodamia fusca Haworth. 4, Jameson Land.

Sympistis zetterstedtii Staudinger. 10, Jameson Land.

Cidaria polata byssata Aurivillius. 15, Jameson Land.

Eumichtis sommeri Lefeb. 2, Milne Land, given to me by Dr. Parat and M. Drach of the French Expedition, who were investigating the geology in Milne Land while we were in Hurry Inlet. This species has been recorded from West Greenland, but not previously from East.

Scoparia centuriella Schiffermüller. 2, Jameson Land. This species has also not previously been recorded from East Greenland, but is known on the west coast.

Pyrausta torvalis Möschler. 1, Jameson Land.

Phthorimœa charcoti Meyrick. 4, Cape Dalton. This hitherto undescribed species named in honour of Dr. J. B. Charcot, leader of the French expedition, is described by Meyrick (1934). No member of the genus has previously been found in Greenland.

(*Borkhausenia pseudospretella* Stn. One specimen was taken on board ‘ Pourquoi pas ? ’ in Scoresby Sound, but was clearly introduced.)

In addition to the above, several larvæ of a moth of the Arctiinæ group were found under stones in Jameson Land. W. H. Tams notes that these are very possibly *Hyphoraia lapponica* Thunberg, found in Arctic North America, of which specimens of the larva are in the British Museum. He adds that identification from the larva alone is unsafe. No member of the family Arctiidæ has previously been recorded from Greenland.

Eighteen species of moth have previously been recorded from East Greenland. The present collection brings the list to twenty-two, two of the additions being new to the whole of Greenland and one to science.

Order COLEOPTERA
(determined by K. G. Blair).

Colymbetes dolabratus var. *grœnlandicus* Aubé. One, Jameson Land.

Coccinella transversoguttata Fald. 3 adults, also larvæ and pupæ, Jameson Land.

Gnypeta sp., possibly *cavicollis* Sahlb. 1, under a stone in Jameson Land. The antennæ are, unfortunately, missing, but the specimen agrees with the description of *G. cavicollis*, especially in having the legs black. There are no specimens for comparison in the British Museum. *G. cavicollis* is the only species of the genus recorded from Greenland, a single specimen having been obtained on Pendulum Island in 74° N.

Twelve species of Coleoptera have been previously recorded from East Greenland, but only the above three have so far been recorded as far north as Scoresby Sound.

Order HYMENOPTERA APOIDEA
(determined by O. W. Richards).

Bombus arcticus K. 6 males and 1 worker, Jameson Land and Liverpool Land.

Bombus hyperboreus Schönh. 1 male, Jameson Land.

These are the only two species of the group known from Greenland (*Richards*, 1927). *B. kirbyellus* Curt., recorded from Scoresby Sound by Rémy (1928 *b*), presumably refers to *B. arcticus* K.

(The Ichneumonidæ are considered in a separate paper by A. Roman.)

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LXII.—*East Greenland Ichneumonids.*

By A. ROMAN, Stockholm.

THE present little collection contains eleven species in sixteen specimens, all collected in 1933 by Mr. D. Lack on Jameson Land, a broad peninsula between Scoresby and Franz Joseph Fjords. Most species are already known from E. Greenland, but one species and the ♀ of another are new to science, and the genus *Cœlichneumon* Thoms. is new for Greenland. The *Saotis* described 1933 by myself is appearing again, and I have found some evidence for its European origin.

Cœlichneumon solutus occidentalis, var. nov.

♂.—A specie genuina Scandinaviæ facie et clypeo totis, femoribus iii. apice (at subtus rufis) tibiisque iii. latere antico rufo excepto, nigris, discedens. Long 9, ala antica 7 mm.

One ♂, Aug.

The ♀ of this small species was described by Holmgren from Mt. Åreskutan in the Swedish province of Jemtland. Both sexes were found on the Sarek Mts. in Lapland, and one ♂ was later recognized from Kuusamo in E. Finland, but this is the first specimen found outside Fennoscandia. It was the ♂ that enabled me to place *solutus* in the *hæmorrhoidalis* (*castaniventris*) group of *Cœlichneumon*; the ♀ had been thrown together with species of *Barichneumon* by Holmgren on account of the not aciculate postpetiolus and the absent basal impression of the third abdominal tergite. Perhaps this variety takes the place of the typical species in arctic N. America. In Lapland this species has its home on the alpine heath beginning at timber-line.

Cryptus arcticus Schiödte.

One ♀, Aug. 4.

A rather common species in both W. and E. Greenland, but unknown in Europe, and is possibly described from America.

Atractodes bicolor arcticus Holmg.

One ♂ Aug. 8, one ♀ Aug.

This pair is somewhat dubious, because the ♀ has almost as slender antennæ as *A. gilvipes* Holmg. of S. Sweden and the ♂ is unusually small, hardly 4 mm. long.

Atractodes aterrimus Holmg.

♀.—Differt a ♂ magnitudine paullo minore, oculis nudis, antennis filiformibus apicem versus distincte incrassatis et moniliformibus, flagello 17 (18)-articulatis, postannello scapo+pedicello æquilongo, articulo 2. circ. triplo longiore quam crassiore, articulis penultimis subsphæricis, mesonoto et scutello politis, illo notaulis medium superantibus, mesopleuris nitidulis at rugulosis speculo polito, segm. mediano rugoso altitudine breviore, ar. media magis nitida subconcava, ar. dentipara subtransversa, abdomine lanceolato leviter depresso, polito, postpetiolo ±elongato, ruguloso, sulco medio plerumque distincto, segmento 2. evidenter elongato, apice quam basi plus duplo latiore, 3° paullo breviore angustato, 4° præcedente saltim duplo breviore, segmentis ceteris brevissimis, pedibus gracilibus femore iii. latitudine fere 6×longioribus, ungue iii. articulo 3. tarsali vix breviore, unguiculis tenuibus at pulvillum parum superantibus, stigmate radium longe pone medium emittente, hamulis alæ posticæ 3–4. Long. vix 4 mm.

Two ♀ Aug. 4, one ♀ Aug. 10, one ♀ Aug., no date.

Originally described from the ♂ alone without observing the unusually strong sculpture of the mesopleura. Lundbeck in 1896 thought the had found the ♀ and " described " it with these words :—" *Fem.* Mari similis, sed pedes paullo dilutiores, tibiis fusco-ferrugineis. Antennis nigro-brunneis. Petiolo quam in mare latiore et magis deplanato; cetera sic ut in mare." The only structural feature held forth is the broader and flatter 1st abdominal segment, a character more than enough developed in the specimen I received as loan from the Copenhagen Museum, for it was—*Phygadeuon cylindraceus* Ruthe, ♀. Thus the real ♀ of *aterrimus* was still unknown, but I think the present specimens may be accepted as such, at least until a ♀ with a still stronger sculpture be found. This ♀ has the size, colour, and habitus of *Stilpnus tenebricosus* Gr., but the areolet is open and the mesopleura are rugulose with the exception of the speculum, so the present determination is certainly possible.

Pimpla sodalis Ruthe.

One ♀, Aug. 4.

Described from Iceland and occurring also at the alpine levels of the Scandinavian mountains, the Alps, and the Pyrenees.

Stenomacrus terebrator, sp. n.

♀.—Nigra, trochantellis saltim pro parte et incisuris ventralibus abdominis testaceis, tibiis basi—posticis latius—tarsisque rufescentibus. Alæ subhyalinæ costa fusca, stigmate et nervis brunneis, radice testacea, tegula rufescente. Long. corporis et alæ anticæ 2·6–2·8 mm.

Caput subcubicum vix thoracis latitudine, facie subopaca, genis longis politis sulco nullo. Antennæ tenues filiformes flagello 17–18-articulato, apicem versus subincrassatæ et moniliformes, postannello quam pedicello saltim dimidio, crassitudine sua fere triplo longiore, articulis penultimis circ. 10 quadratis vel subtransversis. *Thorax* leviter compressus maxima parte politus, segm. mediano supra costis duabus parallelis. *Abdomen* ab apice segmenti 2. modice compressum, longitudine capitis+thoracis vel paullo longius, segmento 1. brevi nitido, latitudine haud longiore, sulco medio et impressione transversa ante apicem distinctis, 2° leviter transverso basin versus subalutaceo, ceteris brevioribus nitidis, terebra sursum curvata valvulis tenuibus nitidis, dimidio abdomine nonnihil longioribus. *Pedes* graciles femoribus posticis latitudine fere 5×longioribus, tibia articulis tribus basalibus tarsi æquali, ungue articulo 3. subæquali, unguiculis tenuissimis pulvillum non superantibus. *Alæ* corporis longitudine, stigmate angusto radium ante medium emittente, nervo areolari brevi, n. parallelo medio, angulo brachiali postico obtuso, appendice costæ longitudine abscissæ 1. radii, n. mediano alæ posticæ ante nervellum solito modo deleto.

Two ♀, Aug. 4 & 12.

This is a species of Thomson's Sectio 5, to which most species of this genus belong. The conspicuous length of the terebra—more than half the abdomen—makes its description as a new species rather certain. Another rare feature is the short and broad first abdominal segment. But if the ♀ is easy to recognize, the ♂ will be difficult to find out, and I suspect it to be one of those mentioned with a dubious name.

Saotis hoeli m., 1933.

One ♀, Aug.

Described from E. Greenland in Skr. om Svalbard og Ishavet, no. 53, Oslo. The present specimen differs from the unique type in being smaller, hardly 6·5 mm., by the entire antennæ with 22-jointed flagellum, by the mainly fuscous max. palpi, by the interior side of the hind femora being distinctly reddish except at base, by the dark reddish middle of the hind tibiæ, by the obsolete red margins of the abdominal tergites, and by the black venter with broadly whitish 2–4 incisures. The polished apical half of the abdomen with rounded sides of the tergites, the last of which are not transverse, and the comparatively narrow sheath of the terebra prove to be constant. In the Stockholm Museum are 3 ♀ from Sweden and Norway looking like a colour-form of this species.

Diplazon annulatus Gr.

One ♂, Aug. 12.

Recorded 1933 from E. Greenland by myself and not rare in N. Scandinavia. The specimen is a very dark one with the yellow facial colour reduced to clypeus, orbits, and a small central spot. Thorax black except the extreme pronotal corners before the tegulæ, both being whitish. Anterior femora black, with the anterior side ±red, the hind ones dark red, with both ends and the underside black. Hind tibiæ black and white, only the anterior side of the tip being dark red. The unusual genus-name is used because *Bassus* Fabr. is evidently a S. American cryptine genus (see Roman, Ent. Tidskr. 1933, p. 38).

Homotropus grœnlandicus Holmg.

One ♂, Aug.

The two Greenland species of this genus are most embarrassing. While two different ♀♀ are known in several specimens, the numerous ♂♂ under the two names seem to form a continuous colour-series with no apparent break between *grœnlandicus* (with more yellow ornaments) and *melanogaster* (with less yellow ornaments). In all, the antennæ have ±linear tyloids on flagellar joints 7–14 (16), and the general structure seems to be the same all through the series. The ♀ attributed to *grœnlandicus* was first noticed by Lundbeck in 1896 and synonymized by me in 1916 with *H. elegans nigritarsus* Gr.; the *melanogaster* ♀ mentioned by Aurivillius in 1890, I stated 1916 to be allied to *dimidiatus* Schrk. and *incisus* Thoms. Being now acquainted with both these species, I find *melanogaster* to be the same as *incisus*, but with one exception, the wing-stigma being yellow instead of dark with whitish basal corner. In the Greenland ♂ the stigma-colour is mostly transparent brown, sometimes shading off to yellow. The ♂ of *incisus* in Europe may be considered as still unknown, for what Morley described in 1905 was a small species, 4–5·5 mm. (*incisus*, ♀, 6–7 mm.), and probably no ♂ at all, the face being coloured as in most ♀♀ with black facial orbits, an unknown colouring among male *Homotropi*.

Agitia grœnlandica m. (*Ailasta*, 1916).

One ♀, Aug. 11.

This species is better placed in *Agitia*, where it comes very near *A. chrysosticta* Gr., which has the same red spots on tergite 3 as the type; the abdomen of the present specimen is totally black. The specific difference between both species is best shown by the length of tergite 2 (longer in *chrysosticta*). This is the first specimen from E. Greenland.

Ailasta frigida Lundb. (*Limneria*, 1896).

One ♀, Aug. 7.

Fits the very incomplete, though rather long, description. Long ago I have seen a typical specimen, permitting me in 1916 to state the correct genus. Next allied is our common European *A. didymator* Thunb. (*ruficincta* Gr.), and in fact there seems to be no other difference than colour. *Frigida* is extremely melanistic with black mandibles, palpi (partly red) and abdomen, basally blackish hind femora, fuscous wing-stigma, and red tegulæ.

LXIII.—*Notes on Arctic Spiders obtained in* 1933.

By A. Randell Jackson.

[Plate XVIII.]

I. *List of Spiders collected by Mr. David Lack, a Member of the Cambridge University Expedition to East Greenland in August* 1933.

This collection consisted of 89 specimens in all, of which 48 were adult and 41 immature, a few very young and indeterminable specimens not being reckoned. Thirteen species altogether were represented, of which five appear to be unrecorded for Greenland at present. These are *Coryphæolanus thulensis*, sp. n., *Coryphæolanus holmgreni* Thorell, *Islandiana princeps* Braendegaard, *Erigone tirolensis* L. Koch, and *Meioneta nigripes* Simon. The first is a new species, which also occurred in Spitsbergen in 1933. The third is only known so far from Iceland. The other three have a wide Arctic distribution, also occurring in Britain. Of the thirteen species altogether five are known from Britain.

Fifty species are now recorded from Greenland, of which sixteen, or thirty-two per cent., occur also in Britain. This includes the present collection. Sixty species are so far known from Iceland (1), of which ninety per cent. are known from Britain. It appears that as far as is at present known the spider fauna of Greenland is mainly American, that of Iceland mainly European.

Dictyna borealis Cambridge.

Two adult females. Jameson Land, 16.8.33.

Five immature examples. One from Jameson Land, one from D'Aunay Fjord, and three from Liverpool Land.

Sörensen in 1898 (9) considered this species as identical with *D. hamifera* Thorell (11) and *D. grœnlandica* Lenz (6). Strand (10) in 1906, however, listed them separately.

Simon (8) in 1914 considered *D. hamifera* Thorell and *D. borealis* Cambridge as synonyms of *D. major* Menge. In 1930 I recorded (3) *D. major* Menge from West Greenland, stating that I believed *D. hamifera* and *D. borealis* to be synonyms. In 1933 (4) I recorded *D. major* from Akpatok on the strength of a single female with a damaged vulva. I was never happy about this, and on comparing the specimen with the two females now recorded for East Greenland it became evident that they were all the same. Dr. Braendegaard, to whom I sent a specimen, stated that he believed they were really *D. borealis* Cambridge, and that *D. borealis* and *D. hamifera* were different species. I next examined the actual type of *D. borealis*, which is in the Pickard-Cambridge collection at Oxford. I found that the Akpatok female and the two now recorded from East Greenland certainly belonged to that species. Re-examination confirms my opinion that the West Greenland specimens recorded as such in 1931, and which included an adult of each sex, are true *D. major* Menge. But whether this is identical with *D. hamifera* Thor. remains to be seen.

D. borealis, therefore, occurs in East Greenland and Akpatok, whilst *D. major* occurs in West Greenland. They may, of course, occur together in suitable localities.

D. borealis differs from *D. major* in the vulva, for which see Pl. XVIII. figs. 1 & 2. There is also a little difference in the abdominal pattern, particularly in the mid-dorsal marking. In *D. major* this is broad and constricted in the middle, thus giving rise to two denticulations on each side. The extremity is trifid. In *D. borealis* the marking is trifid too, but is narrow and linear, without constriction or denticulations.

D. borealis is a smaller, slenderer, more linear species than *D. major*. I have not enough material to decide whether there is any real difference in the ocular relations of the two species, but I believe there is very little in this. The specimens of *D. major* from West Greenland are duller and dingier in colour than those from Scotland which I possess, but there is no other difference.

Xysticus bimaculatus Emerton.

Two adult females. Jameson Land, 16.8.33.

Three immature examples from Liverpool Land.

One immature example, Jameson Land.

These females correspond well with the description of *X. deichmanni* Sörensen (9). I submitted one to Dr. Braendegaard, and he states it is identical with *X. bimaculatus* Emerton. I have followed him in this rather reluctantly, but he has, of course, access to Sörensen's types and has also a considerable number of East Greenland specimens in his collection including adult males. My specimens are rather longer in the vulva than Emerton's figure (2), and I was inclined to stick to Sörensen's name. Emerton's species was described in 1894 and his name has thus priority.

Lycosa grœnlandica Thorell.

Two adult females. Liverpool Land.

One adult female. Jameson Land.

Eight immature examples, four from each locality.

These females resemble those I have seen before from West Greenland. A closely related species, *Lycosa disjuncta* Jackson, replaces *L. grœnlandica* in Akpatok.

Lycosa glacialis Thorell.

Two adult females. Jameson Land, 4.8.33.

Four adult females. Liverpool Land, 11.8.33 and 14.8.33.

The Liverpool Land specimens were carrying egg sacs.

Twenty-four immature examples were obtained, three from Fame Islands, the remainder from Liverpool Land and Jameson Land.

This was the commonest species taken in the collection, there being thirty examples altogether. Unfortunately, no adult male was obtained. I (3) have already recorded this species from Liverpool Land. It has been well figured by L. Koch (5).

Hilaira frigida Thorell.

One adult female. Fame Island, 9.8.33.

One adult female. D'Aunay Fjord, 21.8.33.

Typical females. Recorded by me from West Greenland (3).

Hilaira whymperi Jackson.

Two adult males. Jameson Land, 8.8.33.

One adult female. Jameson Land, 12.8.33

One adult female. Fame Island, 9.8.33.

One adult female. Liverpool Land, 14.8.33.

Recorded by me from North Greenland and Akpatok (4).

Coryphæolanus holmgreni Thorell.

One adult female. Jameson Land.

One adult female. Liverpool Land, 14.8.33.

One male and two females, all adult, Rosenvinge Bay, 18.8.33.

Two adult females, D'Aunay Fjord, 21.8.33.

The Oxford University expedition found this at Akpatok (4) in 1931, but failed to find it in West Greenland in 1928 (3).

Coryphæolanus thulensis, sp. n.

Two males and one female. Jameson Land.

Two females. Jameson Land, 4.8.33 and 16.8.33.

Two females. Fame Island, 9.8.33.

Total seven specimens, all adult.

This is a very distinct species, unknown to me and to Dr. Braendegaard. For description, see *postea*. I have since seen an adult male from Spitsbergen, which was taken under rather curious circumstances. I deal with this in another part of this paper. The present species is quite clearly congeneric with *C. holmgreni* Thorell.

Islandiana princeps Braendegaard.

One adult male. Jameson Land.

One adult female. Jameson Land, 16.8.33.

One adult male. Point Constable, Jameson Land, 5.8.33.

A very distinct little species hitherto only known from Iceland. Recorded thence in 1932 by Dr. Braendegaard (1). Probably reached Iceland from Greenland. The bulk of the Icelandic spider fauna is of European origin.

Cornicularia karpinskii Cambridge.

One adult female. Cape Dalton, 20.8.33.

This is a mountain spider in Britain, and I have recorded it from Akpatok. I sent the present specimen from Greenland to Dr. Braendegaard and asked him to compare it with the type of *Walckenaera insolens*

Sörensen (9). This he kindly did, and informs me that they are identical. *W. insolens* Sörensen, 1898, therefore sinks into a synonym of *C. karpinskii* Cambridge, which was described in 1873 (7).

Erigone psychrophila Thorell.

Four adult males. Jameson Land, 4.8.33.

One adult female. Cape Dalton, 20.8.33.

These males are typical. It is not easy always to distinguish the female from that of *E. whymperi* Cambridge in the absence of the male.

Erigone tirolensis L. Koch.

One adult male and one adult female. Cape Dalton, 20.8.33.

Two adult males. D'Aunay Fjord, 21.8.33.

Typical examples. The females of this species are very easily distinguished from the other Arctic *Erigone* species by the vulva.

Meioneta nigripes Simon.

One adult male and one adult female. Point Constable, Jameson Land, 5.8.33.

One adult male. Jameson Land, 8.8.33.

One adult female and one immature male. D'Aunay Fjord, 21.8.33.

These specimens have hind central eyes very much larger than the laterals, resembling in this respect Scots and Spitsbergen examples and differing from those found at Akpatok, where the hind centrals are only slightly larger than the hind laterals.

DESCRIPTION OF A NEW SPECIES.

Coryphæolanus thulensis, sp. n.

Female.—*Length.* Cephalothorax ·9 mm., abdomen 1·35 mm.

Colour. Carapace yellow-brown with a dark central longitudinal marking extending from the occiput to the thoracic juncture of segments, and the usual radiating lines to the margin of the carapace, which is itself darkened. Ocular area pigmented. *Sternum and lip* dark brown, the former cordiform and studded with yellow spots, and broadly truncated between the posterior coxæ, to each of which its posterior extremity is about equal in width. *Falces* and *maxillæ* yellow-brown. The latter darkened at their apices. *Legs* yellow-brown with the coxæ much suffused with dark brown, and the undersides of the femora a little so. *Abdomen* dark brown studded with yellow spots, these, in my specimens at any rate, are not arranged to form any pattern. Spiracles light yellow-brown, and epigyne very dark brown, almost black. Spinners dark brown.

Carapace. Ocular area higher than clypeus. In profile the carapace is rounded. It rises a little behind the eyes. It then descends to the thoracic juncture and, finally, slopes gradually to the posterior end.

Eyes. Anterior row slightly convex in front, almost straight. Centrals not pigmented and very small. They are one diameter apart and almost twice that distance from the laterals. Posterior row straight, eyes subequal, centrals one diameter apart, rather more from laterals.

Falces. Yellow-brown, more or less parallel-sided. Four large strong well-spaced teeth on the anterior border. Four very minute closely grouped teeth on the posterior border. Parallel rows of "stridulating striæ" on the outer border of the proximal joint. Fang normal.

Maxillæ inclined over the lip. Palpi yellow-brown without terminal claw.

Legs. No true spines on femora, metatarsi, and tarsi. All these joints, however, are clothed with long strong hairs, especially on their under surfaces. This is most marked on the under surfaces of the femora and especially near the apices of those of the third and fourth legs, where the hairs are quite spine-like. Each patella bears a dorsal spine. Tibiæ of the first three pairs each bear two dorsal spines. On the fourth tibiæ only one is present, the distal spine being absent.

Trichobothriæ present on the metatarsi of the three anterior pairs near the middle. These are absent on the fourth metatarsi. Tarsal claws three on each limb. The paired claws each carry six teeth increasing in size from above downwards, the most distal one being easily the largest. Unpaired claw without teeth.

Vulva. See Pl. XVIII. fig. 7.

Male. A little smaller than the female. Carapace lighter yellow-brown. Clypeus higher than in the female, and distinctly higher than the ocular area. The ocular area being deeply pigmented contrasts markedly with the pale carapace. No ocular eminence, cephalic lobe, or postocular striæ.

Eyes much as in the female. Rather more closely grouped. Anterior centrals not pigmented, and hardly two diameters from the laterals.

Falces very divergent, but teeth as in the female. Several dentiform projections on anterior surface bearing long hairs are present. Stridulating striæ on outer borders.

Palpi. Patella very short, no apophysis present. Tibia very short, but very high in profile. An external apophysis is present in the form of a dark plate-like expansion on the outer side. A curved pointed apophysis on the inner side. Tarsus simple, but with a marked external lobe. Paracymbium simple. Embolus represented by a rather short stout process, directed forwards and upwards with a blunt tooth-like projection on its lower side near the apex (*a*). Conductor emboli a stout process sharply bent near its extremity on the outer side of the embolus and partly surrounding it (*b*). A third strong curved process on the inner and lower side of the bulb (*c*). This is placed somewhat in the position of the lamella characteristica of Leptyphantoid spiders, and the whole arrangement of the apical palpal organs rather resembles that of the spiders of that group. See Pl. XVIII. figs. 3 & 6, where the letters *a*, *b*, and *c* indicate these structures.

Other characters as in the female.

This species appears to be a true *Coryphæolanus* not distantly related to *C. holmgreni* Thorell, but easily distinguished by its sexual organs in both sexes.

The Spitsbergen specimen was taken on July 17th, 1933, and was thus the first specimen of this species to be captured. I have, however, made the Greenland specimens types, partly because I received them first and made drawings of them before I had seen the Spitsbergen specimen, and partly because the latter specimen had palpi showing turgescence of the hæmatodocha, and therefore was not so suitable for drawing. Also because there was no female from Spitsbergen.

II. *An Account of some Spiders taken by the Oxford University Expedition to West Spitsbergen in* 1933, *and by Mr. N. V. Polunin at Bellsund in August* 1933.

I am taking these together as they were not very numerous. A number of other specimens were obtained by another member of the expedition at Wijde Bay, but these I have not seen.

Six species were represented, of which one was undescribed. Although taken before the East Greenland specimens of *Coryphæolanus thulensis*, sp. n., it was already described before the single Spitsbergen example of this species came into my hands.

Erigone psychrophila Thorell.

A male and two females obtained on May 28th by Mr. J. M. Fisher at Klaas Billen Bay, and another male by Mr. A. R. Glen, probably at the same locality.

Erigone arctica White.

A single female inside the base-hut at Petunia Bay, Klaas Billen Bay, by Mr. A. R. Glen on August 21st, 1933.

Hilaira glacialis Thorell.

One female at Bellsound in August 1933 by Mr. N. V. Polunin.

Microerigone spetsbergensis Thorell.

Three males, five females, and immature examples taken by Mr. Fisher at Klaas Billen Bay on May 28th, 1933. He also obtained a female at Petunia Bay under a stone on July 9th.

Meioneta nigripes Simon.

A male by Mr. N. V. Polunin at Bellsund in August 1933. This was of the European type with the very large posterior central eyes.

All the above have occurred in Spitsbergen before.

Coryphæolanus thulensis, sp. n.

A male of this hitherto undescribed species, which is described now in this paper on page 615 and figured on Pl. XVIII., was captured at Bruce City, Klaas Billen

Bay, by Mr. J. M. Fisher on July 17th, 1933. He had occasion to shoot a fulmar for food. It was shot flying and fell on the beach. He at once picked it up—it did not lie on the beach more than a minute or so. He carried it into the hut on the beach and placed it on a piece of paper on a bench. The hut is a permanent wooden structure with a wooden floor. On proceeding to examine the bird, the spider was observed running on the paper on which the fulmar was lying. The species was undescribed. A month later it occurred more numerously in East Greenland, where it was taken by Mr. David Lack.

Have we here an instance of a spider being transported by a bird ? It may, of course, have been on the beach or in the hut. This district is, however, the best-known part of Spitsbergen as far as spiders are concerned, but that proves nothing, although no one had observed this species there before. If it travelled *on* the bird it may have come from some adjacent district hitherto unexplored, though not far away. The fulmar, Mr. Fisher informs me, never lands except to breed. If transported from East Greenland, the bird must have landed there first, acquired the spider and then changing its mind flown to Spitsbergen.

The hæmatodocha was distended and turgid. This should mean sexual excitement, which in turn would postulate a local female. When adult, however, the turgescence is sometimes produced by immersion in spirit—wine and women, in fact. The strong probability is that the spider was on the beach or in the hut. The next most likely event is that if on the bird it was obtained locally. Its transportation by sea from a distant country like East Greenland is very unlikely. Whether this ever occurs is not known positively as yet. The supporters of this theory will, however, be able to use this case as an argument in their favour.

Note.—Whilst this paper has been in the press, a small but important paper has appeared dealing with the synonymy of Greenland spiders. This is by Dr. J. Braendegaard, and is entitled " Preliminary Statement of the Synonymity of certain Greenland Spiders." Dr. Braendegaard has access to Sörensen's collection in the Copenhagen Museum and has been examining some of his types. He has established the identity of *Hilaira whymperi* Jackson with *Notioscopus ? curvitarsis* Sörensen. This spider should now be called *Hilaira curvitarsis* Sörensen. *Meioneta nigripes* Simon has already been recorded for Greenland sub *Tmeticus levinseni* Sörensen. Also *Coryphæolanus holmgreni* Thor. was recorded by Sörensen from Greenland sub *Walckenaera similis* Sörensen. So *C. holmgreni* Thorell and *Meioneta nigripes* Simon are not new to Greenland as I stated in the first paragraph of this paper.

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EXPLANATION OF PLATE XVIII.

Fig. 1. *Dictyna major* Menge. West Greenland specimen. Vulva from below.
Fig. 2. *Dictyna borealis* Camb. East Greenland specimen. Vulva from below.
Fig. 3. *Coryphæolanus thulensis*, sp. n. Right palpus from outer side.
Fig. 4. Ditto. Right palpus from above showing tibia. *p*, paracymbium.
Fig. 5. Ditto. Right palpal tibia from inner side.
Fig. 6. Ditto. Right palpal organs from inner side and in front.
Fig. 7. Ditto. Vulva from below.

LXIV.—*New West Indian* Curculionidæ (*Col.*).

By Sir GUY A. K. MARSHALL.

BRACHYDERINÆ.

Lachnopus bivirgatus, sp. n.

♂♀. Derm black, with sparse metallic pale green scales, which are more sparse in ♂ than in ♀; head and prothorax without any definite pattern; elytra with a macular stripe of scales on interval 5, and sometimes in the ♀ with an additional spot before the middle on 3, and behind the middle on 6 and 7; underside with very sparse pale green or whitish scales and a dense lateral patch on the metasternum.

Head with rather close shallow punctures and a small frontal fovea, and with a very shallow transverse impression on a line with the hind margin of the eyes, which are moderately convex in ♂ and slightly less so in ♀. *Rostrum* about as long as broad, shorter than the head, moderately dilated at the apex, with scattered shallow punctures and sparse scales, without any median sulcus, and the apical declivity starting at about the middle. *Antennæ* with the scape reaching or slightly exceeding the hind margin of the eye; the funicle with joint 1 distinctly longer than 2, 3 longer than 4, 4–7 subequal, about as long as broad but widening distally. *Prothorax* as broad as long in ♂, slightly broader in ♀, gently rounded at the sides, broadest about the middle, the basal margin subtruncate, and with a slight subapical constriction (almost obsolete in ♀), which is continued shallowly across the disk; the dorsum almost flat longitudinally, with very shallow rugulose punctation, which is in part transversely confluent. *Elytra* of ♂ very narrow and elongate, parallel-sided to beyond the middle, separately rounded at the apex; the shallow regular striæ containing rather large subquadrate punctures, which are wider than the intervals near the base, but become gradually smaller behind; devoid of setæ except near the apex; elytra of ♀ broader, widest behind the middle, much more acuminate behind, with the apices contiguous, the intervals broader, and the suture bearing a group of long erect setæ at the top of the declivity. *Legs* testaceous, with a few sparse scales; all the tibiæ with small denticulations, the hind pair of ♂ straight and scarcely differing from that of ♀.

Length 5·0–6·2 mm., breadth 1·8–2·0 mm.

CUBA: Cumbre, Pico Turquino, 5500–6000 ft., 4 ♂♂, 5 ♀♀, vii. 1922 (*S. C. Bruner & C. H. Ballou*).

A small and unusually slender species, especially in the ♂, with a characteristic pattern on the elytra. It belongs to the group of *L. coffeæ* Mshl. (Bull. Ent. Res. xiii. 1922, p. 60, pl. i. fig. 8), the females having a very similar facies; but in *coffeæ* the rostrum is longer and more slender; the punctures on the disk of the pronotum are much larger and deeper, being as large as those on the base of the elytra; the ♂ has long curved hairs on the hind tibiæ, and the ♀ has no tuft of setæ on the declivity.

Lachnopus alboguttatus, sp. n.

♂. Derm black, with numerous spots and patches of white scales; head and rostrum rather sparsely squamose; prothorax with a transverse row of four spots at about the middle, the two median spots being further from each other than each is from the lateral spot, and a rudimentary spot on each side of the base; the intervals of the elytra with the following spots: five on interval 3 evenly spaced from base to apex, one at the base of 4, three on 5 from base to apex, 6 with one at the base, 7 with four (the two before the middle often united), 8 with one at the base and an elongate one before the middle, 9 like 8; the basal spots form a macular transverse band, and the antemedian spots on 7–9 usually unite to form a large patch; all the spots extend laterally to cover the striæ on each side of the interval on which they lie; underside with only a few sparse scales.

♀. The spots similar, but the spaces between them with many isolated scales, especially on the prothorax and at the apex of the elytra, so that the spots are less sharply defined; underside with numerous scales, which are denser laterally.

Head slightly impressed dorsally behind the eyes, with rather close shallow punctures and an elongate frontal fovea; the eyes moderately convex in ♂, much flatter in ♀. *Rostrum* about as long as the head, longer than broad, straight dorsally, the apical declivity commencing at two-thirds from the base; the dorsum with a very shallow broad median furrow. *Antennæ* with the scape reaching the hind margin of the eye; all the joints of the funicle elongate, 1 slightly longer than 2, and 3 than 4, 4–7 equal, 7 not wider than the others. *Prothorax* nearly as long as broad, gently rounded at the sides, widest at the middle, with a shallow constriction near the apex which is not continued across the disk, the base truncate; the dorsum gently convex longitudinally, with fairly close shallow punctures and a rounded impression on each side of the disk containing the two median white spots. *Elytra* narrowly elongate in ♂, much wider in ♀, parallel-sided to about the middle, separately rounded at the apex in ♂, jointly acuminate and shortly produced in ♀; the shallow, partly sinuous striæ containing deep rounded punctures, which are closer in the ♂ and diminish behind; the discal intervals narrower than the punctures in ♂, much wider in ♀; no setæ, except along the apical margin, and a few erect ones on the declivity at the suture in ♀. *Legs* sparsely squamose in ♂, more densely in ♀; all the tibiæ finely denticulate, the teeth on the hind pair of ♂ rather larger.

Length 6·5–9·5 mm., breadth 2·2–3·5 mm.

CUBA: Sierra Maestra, 3700 ft., 1 ♂, 1 ♀, vii. 1922 (*C. H. Ballou & S. C. Bruner*).

Two other Cuban species, *L. multipunctatus* and *niveo-irroratus* Duval, 1856, are apparently (judging by the descriptions) somewhat similarly marked with white spots, but both of them differ from the present species in having erect setæ.

OTIORRHYNCHINÆ.

Prepodes humeridens, sp. n.

♂♀. Shiny black; head, rostrum, prothorax, and underside bare; elytra with a transverse patch of pale scales, having a coppery reflexion between rows 4 and 7 at one-fourth from the base and a similar one behind the middle.

Head slightly rounded laterally, with sparse small shallow punctures and a very small frontal fovea; the eyes not very convex, projecting only slightly beyond the sides of the head, deepest at the middle. *Rostrum* much shorter than usual, only a little longer than broad, gradually widening from base to apex, transversely convex at the base, the flattened discal area narrowing basally and bearing a broad low shiny impunctate median costa, the space on each side of it with small close shallow punctures; the apical declivity not very steep. *Antennæ* with sparse grey pubescence, the club brown; the scape reaching the hind margin of the eye; the funicle with joints 1 and 2 equal, 3 longer than 4, 4–6 equal and about as long as broad, 7 as long as 4 but broader. *Prothorax* as long, or nearly as long, as broad, strongly rounded at the sides, more narrowed in front than behind, widest in front of the middle, with a narrow subapical constriction, which is continued shallowly across the disk, the basal angles almost right angles; the dorsum convex longitudinally, highest at the middle, with a deep median sulcus from base to apex, the disk with minute obsolescent punctation and a few variable large shallow punctures laterally. *Scutellum* very small, bare, and impunctate. *Elytra* oblong-ovate, with a sharp conspicuous lateral angular projection at the shoulders, the apices separately produced into a short acute process, the basal margin lobate on each side, and a broad transverse impression behind the scutellum extending laterally to interval 4; the dorsal curvature normal, the dorsum not striate but with rows of large round deep punctures, which are very remote and unevenly spaced in the rows, thus giving a general effect of irregular coarse punctation, though actually the rows are fairly regular; the declivity rugose, the punctures being there much larger and subconfluent; setæ absent, except for a few minute ones at the apex. *Legs* with the femora bare, the tibiæ sparsely setose, but the tarsi with dense pale blue setiform scales.

Length 7–10 mm., breadth 2·9–4·0 mm.

Cuba: Cumbre, Pico Turquino, 6 ♂♂, 2 ♀♀, 22. vii. 1922 (*S. C. Bruner & C. H. Ballou*).

A very distinctive species, with its 4-spotted elytra and blue tarsi, its sulcate and apically constricted prothorax, sharply angulate shoulders, and unusually punctate elytra. It is allied to *P.* (*Exophthalmodes*) 13-*maculatus* Guér., which has also a sulcate prothorax and a trace of the humeral angulation, but which differs strikingly in its colouring, the sculpturing of the elytra, etc.

Prepodes frenatus, sp. n.

♂♀. Derm black to red-brown, with fairly dense pale blue or greenish-blue scaling, and a white or greenish-white stripe on each side starting at the apex of the prothorax and continued on intervals 4 and 5 of the elytra to the top of the declivity, the stripe being sharply defined on the prothorax and macular or sinuous on the elytra; head and rostrum grey; underside pale greenish or pinkish.

Head strongly convex transversely, with fine punctation on the disk; the eyes very convex, subconical, highest much behind the middle. *Rostrum* elongate, dilated at the apex, with the dorsal outline moderately curved, very convex transversely, finely and sparsely punctate, with a slightly raised smooth median line and rather densely squamose on each side of it. *Antennæ* red-brown, with grey pubescence; the scape reaching the hind margin of the eye; the funicle with all the joints much longer than broad, 2 very slightly longer than 1, and 4–7 equal. *Prothorax* transverse, rounded at the sides in ♂, almost parallel-sided in the basal half in ♀, widest about the middle, scarcely constricted at the apex, shallowly bisinuate at the base, with a deep transverse furrow in the middle of the base; the dorsum with fine sparse punctures, which contain minute recumbent setæ on the more sparsely squamose blue areas, the white stripes being densely squamose with much longer stouter setæ, the lateral areas coarsely punctate. *Scutellum* shield-shaped, squamose. *Elytra* broadly ovate and with prominent shoulders in ♀, much narrower in ♂, with the apices divergent and each sharply acuminate, the basal margin only very slightly overhanging; the rather small punctures in the shallow striæ partly concealed by scaling, only the two sutural and four lateral striæ regular; the intervals flat, the setæ as on the pronotum. *Legs* black or piceous, with dense grey or pale blue scaling; the tibiæ not sulcate, finely denticulate internally.

Length 10–14 mm., breadth 3·8–6·2 mm.

Haiti: Port au Prince, 1 ♂, vi. 1926 (*G. N. Wolcott*—type); Kenscoff, 1 ♀, v. 1927 (*G. N. W.*). Dominican Republic: 1 ♀.

Prepodes pictus fulvovirgatus, subsp. n.

This strikingly distinctive form of *P. pictus* Guér. appears to be mountain race. In the typical form each elytron bears two large elongate dorsal patches, the basal one being white and the apical one bright pink (often fading to whitish); in the present race these patches are united into a broad bright orange or fulvous stripe, which is somewhat narrowed in the middle; the white lateral stripes on the prothorax and elytra are also replaced by orange ones. There appear to be no structural differences whatever.

Superficially this form presents a greater resemblance to the Haitian *P.* (*Exophthalmodes*) *quadrivittatus* Oliv. than it does to its own typical form.

Length 12–16 mm., breadth 4·25–6·5 mm.

CUBA: Sierra Maestra, 3000–4000 ft., 4 ♂♂, 4 ♀♀, vi. 1922 (*C. H. Ballou & S. C. Bruner*).

Pseudeustylus planicollis, sp. n.

♀. Derm black, with dense sandy-brown scaling, the only marking being a broad common chevron-shaped patch on the elytra which extends laterally to stria 6 or 7, its apex lying on the suture near the top of the declivity.

Head with a narrow frontal stria, the eyes only slightly convex. *Rostrum* short, not longer than the head, almost parallel-sided, only slightly dilated at the apex, the basal portion convex and with a shallow median stria which is continuous with that on the forehead; the interscrobal area much narrowed in the middle, being there little more than half as wide as the forehead; the apical area strongly convex transversely, without impressions, smooth and with fine shallow punctation. *Antennæ* with the two basal joints of the funicle equal. *Prothorax* as long as broad, parallel-sided in the basal half, roundly narrowed in front, with the basal margin gently arcuate; the dorsum coarsely punctate, but the punctures almost concealed by scaling, the greater part of the disk being occupied by a triangular depression having its apex on the front margin. *Scutellum* subquadrate, almost bare. *Elytra* parallel-sided to beyond the middle, shallowly sinuate jointly at the base, with the shoulders prominent and broadly rounded, a flattened area just behind the scutellum, the subapical callus prominent, and the apices separately pointed; the shallow striæ with rather large punctures that are almost concealed by the scaling; the suture somewhat elevated on the declivity, interval 7 subcostate in the basal half, 3 and 4 slightly raised for a short distance near the base and 3 and 5 behind the middle; the setæ minute and recumbent. *Legs* with dense concolorous scaling; all the femora with a very small tooth.

Length 8·0–8·5 mm., breadth 3·2–3·5 mm.

CUBA: Sierra Maestra, 3500–4500 ft., 2 ♀♀, vii. 1922 (*C. H. Ballou & S. C. Bruner*).

The two previously known species of the genus, described by Champion (1911) from Central America, differ strikingly in coloration; further, in both of them the rostrum is longer, more dilated apically, and with the interscrobal area as broad as or broader than the forehead; joint 2 of the funicle is longer than 1; the pronotum is not impressed; the intervals on the elytra are not uneven, and the setæ are short and erect.

LEPTOPINÆ.

NESOLORDOPS, gen. nov.

Nearly allied to *Lordops* Schh., but differing from it in a series of characters which seem to justify the erection of new genus.

Prothorax with a median sulcus, deeply bisinuate at the base, with the basal angles projecting acutely backwards, the postocular lobes small and sharp. *Elytra* only slightly wider than the base of the prothorax, separately arcuate at the base, 12-striate, with the basal angles broadly rounded, and the shoulders oblique. *Wings* functional. *Legs* with the femora unarmed; a sharp mucro on the anterior pairs of tibiæ, the corbels of the hind pair only narrowly enclosed. *Sternum* with the metasternum much longer than ventrite 1 behind the coxæ.

Genotype: *Nesolordops myersi*, sp. n.

Nesolordops myersi, sp. n.

♀. Black or piceous brown, with pale yellowish scaling; rostrum with a narrow lateral stripe which continues along the inner margin of the eye; prothorax with a narrow median stripe and a much broader lateral one which narrows in the middle; elytra with yellowish stripes on intervals 2, 4, 6, 8, 11, 12 and on the apical half of 10, and usually a spot at the base of 3 and 5, the stripes more or less covering the striæ on each side of the interval, and that on 8 interrupted in the middle;

underside with dense yellowish scales along the sides of the sternum (but not on the metepisterna) and basal ventrites, with sparse hair-scales elsewhere.

Head with fine shallow punctation, without any frontal fovea, the eyes almost flat. *Rostrum* about as long as broad, widest at the base, gradually narrowing to the middle, not dilated at the apex, transversely convex dorsally, with very close fine punctation; a sharp lateral carina from the antenna to the front margin of the eye, and a broad shallow furrow adjoining it above; the declivous apical area broadly impressed. *Antennæ* with the scape reaching the hind margin of the eye, gradually clavate, somewhat compressed; the funicle with the two basal joints equal, 3 a little longer than 4, 4–7 subequal, about as long as broad. *Prothorax* a little broader than long, widest at the base, gradually narrowed in front, with the sides slightly rounded, shallowly constricted at the apex, the apical margin arcuate dorsally, the median basal lobe broadly rounded; the dorsum longitudinally convex, with fine separated punctures and much finer shallow punctation between them, a narrow median sulcus that is deeper at the base, and a much broader sulcus on each side which is filled by the lateral stripe; the setæ on the bare areas minute and recumbent, those among the scales longer and broader. *Scutellum* subquadrate, sparsely setose. *Elytra* oblong-ovate, parallel-sided from the narrow obliquely-rounded shoulders to beyond the middle, jointly and obtusely acuminate at the apex; the dorsal outline flat from the base to beyond the middle, the apical declivity steep; the shallow striæ containing deep close rounded punctures, which are for the most part more or less concealed by scaling, striæ 5–7 coalescing near the base; the bare intervals mostly broader than the others, slightly convex and with minute shallow punctation, which is often confluent; the scales almost round and overlapping, the setæ as on the pronotum. *Legs* piceous to red-brown, with rather sparse narrow pale scales, which are broader and denser on the upper edge of the hind femora; the tibiæ finely denticulate internally.

Length 10·0–10·5 mm., breadth 3·7–4·0 mm.

Cuba: Soledad, 3 ♀♀, on *Panicum maximum*, vii.–viii. 1929 (*Dr. J. G. Myers*).

APIONINÆ.

Apion xanthoxyli, sp. n.

♂♀. Derm red-brown, the head and rostrum with sparse yellowish scaling above; prothorax with fairly dense yellowish-brown scaling (sometimes varying to greyish) dorsally, which does not entirely conceal the integument, the lower surface with much denser whitish scaling; elytra with yellowish-brown scaling more or less interspersed with grey or whitish scales, and with a large common oval transverse patch of dark brown and fulvous scales in the middle of the disk, which is surrounded by an indefinite border of whitish scales; underside with rather dense yellowish or whitish scaling, but bare in the middle of ventrites 3 and 4.

Head shallowly impressed transversely behind the eyes; the forehead a little narrower than the base of the rostrum, finely rugulose; the eyes strongly convex and coarsely facetted. *Rostrum* as long as the pronotum, slightly curved, constricted at the base, moderately stout, angulated above the antennæ, parallel-sided in the apical half, shallowly rugulose in ♂, more finely punctate but otherwise similar in ♀. *Antennæ* ferruginous; joint 1 of the funicle subglobular and its apical half with dense white scaling, the remaining joints with stiff white erect setæ, 2 and 3 longer than broad, 4–7 transverse, 7 the widest; the club broadly ovate, with long fine erect setæ. *Prothorax* as long as broad, subconical, widest at the base, which is deeply bisinuate, strongly narrowed to the apex, with the sides almost straight, but with a shallow subapical constriction; the dorsum highest at the base and sloping steeply forwards, forming a continuous line with the steep anterior declivity of the elytra, with shallow fine punctation, which is partly concealed by the setiform scales. *Scutellum* small, almost an equilateral triangle, bare. *Elytra* short and broad, with the shoulders very prominent; the dorsal outline extremely convex, highest at about one-third from the base and sloping almost as steeply in front as behind; the striæ deep but narrow, with rather shallow catenulate punctures which are mostly hidden by the scaling; the intervals flat, much broader than the striæ, with fine shallow confluent punctation; the scales elongate, those on the disk narrower than the lateral ones. *Legs* stout, ferruginous, with fairly dense pale scaling; the claws stout, divaricate, black.

Length 2 mm., breadth 1·1 mm.

PORTO RICO: Guanico Forest Reserve, 4 ♂♂, 2 ♀♀, bred from seeds of West Indian Satinwood (*Xanthoxylum flavum*), viii. 1932 (*Oscar R. Torres*).

A striking species allied to *A. peculiare*, Wagn., 1909 (=*gibbosum*, Sharp, nec Hbst.), which it much resembles in general facies (*cf.* Biol. Centr.-Amer., Col. iv. pt. 3, pl. iii. fig. 21), but the elytra are much less conically elevated and the highest point is further forwards. Further, *A. peculiare* has the rostrum much broader, strongly narrowed to the apex, and not constricted at the base; the scutellum is much larger, being twice as long as its basal width; the elytra have much sparser scaling, and the striæ are much deeper and as wide as the intervals.

The specimens were kindly submitted to me by Mr. George N. Wolcott.

ITHYPORINÆ.

Conotrachelus cariniscutum, sp. n.

♂. Derm black, with pale brown, white, and grey scaling; head brown, with two round whitish spots; rostrum with an ill-defined whitish median spot near the base and another on each side behind the middle; prothorax brown, with the following ill-defined whitish markings: a narrow lateral stripe from the base to three-fourths, an oblique sinuous stripe from the basal angle to near the middle of the apical margin, and a T-shaped median marking in the basal half; elytra with a broad common curved white band behind the middle, which reaches the lateral margin and is continued as a broad macular stripe to the shoulder extending inwards as far as stria 5, the posterior margin of the band being more sharply defined and dentate but continued macularly along the suture to the apex, there being a large dark transverse patch on each side of the declivity; metasternum with a large lateral white patch which also covers the mesepimeron; venter bare and shiny except for a few white and yellow-brown scales at the sides of the last three ventrites.

Head with dense shallow punctation. *Rostrum* as long as the pronotum, stout, strongly curved, shiny and tricarinate dorsally, with a bare shiny triangular patch in the middle of the base, the lateral areas shallowly impressed and opaque; very similar in shape and sculpture to the rostrum of *cristatus* Fhs. *Antennæ* testaceous-brown, inserted at one-fourth from the apex of the rostrum; the funicle with joint 2 slightly shorter than 1, 5–7 transverse. *Prothorax* transverse, gradually widening from the base to three-fourths and there abruptly narrowed and constricted near the apex, the basal margin rather deeply bisinuate; the dorsum rather strongly convex longitudinally, opaque, with large shallow rugose punctures and four small round shiny raised patches in the middle of the disk, the median carina narrow in the apical half, dilated in the middle into a broad shiny patch and disappearing basally; the pleuræ with a large impunctate patch on the basal half. *Scutellum* bare, with a strong median carina. *Elytra* ovate, shallowly sinuate behind the shoulders, which are rounded and project slightly forwards; the striæ quite regular, with shallow subquadrate punctures that are almost hidden by the scaling; the alternate intervals carinate, the carinæ low and narrow, the first almost obsolete in the basal half and broadly interrupted behind the middle, the second interrupted twice. *Legs* with the tibiæ and tarsi testaceous-brown, the femora blackish and mottled with white and yellow-brown scales; the femora bidentate, the hind tibiæ of ♂ not excavate at the apex, the claws with a sharp basal tooth. *Venter* shiny, with very sparse small shallow punctures; the last ventrite with a deep punctate fovea on each side and a broad transverse impunctate impression in the middle, the latter being probably confined to the ♂.

Length 4·2–5·0 mm., breadth 2·0–2·5 mm.

CUBA: Soledad, 1 ♂, on leaf of sugar-cane, 27.viii. 1929 (*Dr. J. G. Myers*—type). S. DOMINGO: Moca, 1 ♂, viii. 1928 (*Dr. G. Russo*).

Belongs to the group of *nenuphar* Hbst., which species it resembles in size and general shape, but it may be distinguished from the other members of the group by the shiny patches on the rostrum and pronotum, the impunctate area on the pleuræ, the regular striæ and low carinæ on the elytra, the shiny venter, and especially the carinate scutellum.

LXV.—*Oxford University Expedition to British Guiana, 1929.—Diptera Nematocera.* By F. W. EDWARDS, M.A., Sc.D.

THE Diptera Nematocera collected by the Oxford University Expedition to British Guiana are mainly Culicidæ and Tipulidæ, most, if not all, of the specimens belonging to known species. The Culicidæ are for the most part common species already recorded from British Guiana or Surinam, and many of the Tipulidæ are the same as those reported by Alexander (Trans. Amer. Ent. Soc. xl. pp. 223–255, 1914) as having been taken by Mr. H. S. Parish on the Essequibo River near Bartica. There are, however, several interesting records of breeding-places of mosquitoes and of specimens captured high up in trees, and one *Geranomyia* is described as new.

A list of the species in the collection is given below; all were obtained by Mr. O. W. Richards on the Moraballi Creek, Essequibo River, British Guiana, August and September 1929.

Culicidæ.

Anopheles mediopunctatus Theo. Biting, 110 ft. up Barramalli tree (*Catostemma commune* Sandwith).

Megarhinus hæmorrhoidalis F. Secondary forest.

Megarhinus moengoensis B.-W. & B. (?). Dark forest.

Trichoprosopon digitatum Rond.

Goeldia longipes Fab. On flower of *Matayba inelegans* Radlk. in dark forest.

Sabethes cyaneus Fab. 1 ♀ captured up Mora-bukir tree (*Dimorphandra gongrijpii*), 90 ft. from ground. 1 ♀ in dark forest. 1 ♀ in clearing.

Sabethes belisarioi (*goeldii* D. & K.). Captured 100 ft. up Mora-Bukir tree.

Sabethes tarsopus D. & K.

Orthopodomyia fascipes Coq. In light-trap, 80 ft. up Mora-bukir tree.

Mansonia fasciolata L.-A. In light-trap, 80 ft. up tree.

Aedes arborealis B.-W. & B. Biting in trail at 2 P.M. on a sunny day, 21. ix. 29, and in day-time in dark forest, 26. viii. 29. Also bred from water in conical fungus, together with *Culex urichi* Coq. A little-known species previously only recorded from Surinam.

Culex (*Lutzia*) *bigoti* Bell. In light-trap hung at 90 ft. up Mora-bukir tree.

Culex (*Carrollia*) *urichi* Coq. Bred from a tree-hole 110 ft. up Mora-bukir tree, and from another tree-hole at ground-level; also bred from water contained in a conical fungus (*Stereum hydrophorum* Berk.) growing on fallen trunks.

Tipulidæ.

Brachypremna candida Alex. Pairing tail to tail on tree in dark forest.

Brachypremna williamsoni Alex. In dark forest.

Megistocera longipennis Macq. At light.

Holorusia sp. cf. *strangalia* Alex. Perhaps an undescribed species.

Limonia (*Geranomyia*) ? *cinereinota* Alex. In light-trap 50 ft. up Mora-bukir.

Limonia (*Geranomyia*) *gelatifex*, sp. n.

Head dark greyish above and on the very narrow frontal strip. Antenna black, with the second segment brownish, all flagellar segments rather elongate-oval. Proboscis black, in ♂ nearly twice as long as thorax, in ♀ not quite so long. *Thorax* ochreous; præscutum with three somewhat darker brownish stripes, variable in distinctness but never conspicuous; pleuræ unmarked, light ochreous. *Abdomen* brownish ochreous, unbanded. Hypopygium of ♂ with coxite (basistyle) short, ventral style large and fleshy, three times as long as basistyle, its rostral prolongation slightly thickened beyond the middle, then rather pointed; dorsal spine stout, straight, blackened, of moderate length, set on a long tubercle at extreme base of rostral prolongation; ventral spine represented by a fine short hair on a small tubercle, more or less hidden beneath base of dorsal spine. *Legs* uniformly light brownish, no femoral rings and no darkening at tip of front tibia. *Wings* nearly clear, with three dark clouds towards costa, situated at middle of *R*, base of *Rs*, and stigma; lighter clouds over tip of *Rs*, cross-veins, and tip of *Ax*. Halteres of moderate length, with brownish knob. Wing-length about 7–8 mm.

Type ♂ "hatched from green pupa in transparent jelly on leaf"; other specimens (7 ♂♂, 3 ♀♀) taken swarming over dead leaf of shrub in dark forest and in light-trap 50–80 ft. up Mora-bukir tree. Also 1 ♂ in British Museum from Gorgona I., 2° 59′ N., 78° 20′ W. (*Miss L. E. Cheesman*), this last differing in some small details from the Guiana specimens.

This species seems clearly distinct from any of those hitherto reported from British Guiana, and, though I have studied the descriptions of over 50 Neotropical species of the subgenus, I have been unable to find one which exactly fits the specimens before me; the nearest ally is perhaps *L.* (*G.*) *recondita* Alex., of Peru, of which the male hypopygium is undescribed. *L. gelatifex* is evidently widely distributed in South America, as is evidenced by its occurrence on Gorgona I., and it is not improbable that some earlier name will be found applicable to it, but, in view of the remarkable facts recorded concerning the pupa, it seems desirable to give a definite name to these specimens. The form of the "rostral spines" of the male hypopygium is rather peculiar and should make future recognition of the species easy.

Major R. W. G. Hingston, in 'A Naturalist in the Guiana Forest' (1932, p. 332), figures the pupa of this species and says:—"It seems to be unknown that any kind of Diptera go in for making pensile nests. But in the forest there was a crane-fly, *Geranomyia*, which suspended its pupa in a globule of jelly wrapped around the tip of a turu palm leaf. The globule was a firm gelatinous substance, rather smaller than a hazel-nut and as clear as water. Indeed, its appearance was that of a large drop of water about to fall from the end of the palm leaf. It was oval in shape, broader above and pointed below, and was wrapped completely round the thready leaf about half an inch from its extreme tip . . ."

Limonia (*Geranomyia*) sp. At light 80 ft. up camp tree.

Limonia (*Arhipidia*) *schwarzi* Alex. In light-trap, 100 ft. up tree.

Limonia (*Arhipidia*) *subcostalis* Alex. In light-trap, 20 ft. up Mora-bukir tree.

Helius albitarsis O.-S. Dancing in and out of hollow tree-stump.

Ceratocheilus americanum Alex. One in clearing, one in dark forest.

Trentepohlia pallipes Alex. In clearing.

Gnophomyia ? olssoni Alex. One specimen; also in British Museum from Gorgona I.

Gnophomyia ? laticincta Alex. On stump in swamp.

Gnophomyia decisa Alex. At light, 100 ft. up tree; also *in cop.* in tent at night.

Psaronius obscurus Fab. At light.

Psaronius fuscipennis Alex. In dark forest; flying quickly to and fro over ground at dusk.

Psaronius pygmæus Alex. One specimen.

Epiphragma fabricii Alex. Dark forest.

Polymera hirticornis Fab. Dark forest.

Polymera niveitarsis Alex. Dark forest.

Eriocera kaieturensis Alex. One specimen.

Bibionidæ.

Plecia plagiata Wied.

Plecia collaris Fab.

Plecia rufithorax Walk.

Mycetophilidæ.

Sciara (Trichomegalosphys) melanocephala Fab.

Delopsis sp. Hovering in swarm under overhanging branch in dark forest.

LXVI.—*Preliminary Diagnoses of some new Races of South Arabian Mammals.* By R. I. Pocock, F.R.S. (Unofficial Assistant in the Zool. Dept., Nat. Hist. Museum).

The following apparently hitherto undescribed races of mammals from S. Arabia will be more fully dealt with in a paper to be published in this Magazine early in 1935.

Paræchinus dorsalis albior, subsp. n.

Type from Dhimir Wadi, Geradun, 960 ft. (*Bertram Thomas*).

Distinguished from typical *P. dorsalis* by having the pale areas of the spines on the flanks and sides of the back white, instead of decidedly yellow, and the hairs on the front of the limbs mostly greyish white, instead of dark blackish brown.

Arvicanthis niloticus naso, subsp. n.

Type from Lahej near Aden (*J. W. Yerbury*).

Distinguished from other races of *A. niloticus* by the average greater abundance of ochreous or rusty-ochreous hairs on the summit and sides of the muzzle.

Canis lupus arabs, subsp. n.

Type from Ain, 1500 ft., S.E. Arabia (*Bertram Thomas*).

Distinguished from the small Indian wolf (*C. lupus pallipes*), with which it has been confused, by the average smaller skull.

Vulpes ruppelli sabæa, subsp. n.

Type from Rab al Khali (*Bertram Thomas*).

Distinguished from the other races of Ruppell's sand-fox by its smaller size and generally more uniformly sandy colour.

Hyæna hyæna sultana, subsp. n.

Type from Mt. Qara in Ain, 1500 ft., S.E. Arabia (*Bertram Thomas*).

Distinguished from the previously named races of *H. hyæna* by the average smaller size of its skull and teeth.

Oryx leucoryx latipes, subsp. n.

Type probably from Wadi Gudun in Nejd.

Distinguished on the evidence of a single skin from typical *leucoryx* by the unusual width of the hoofs, which recall those of the Addax.

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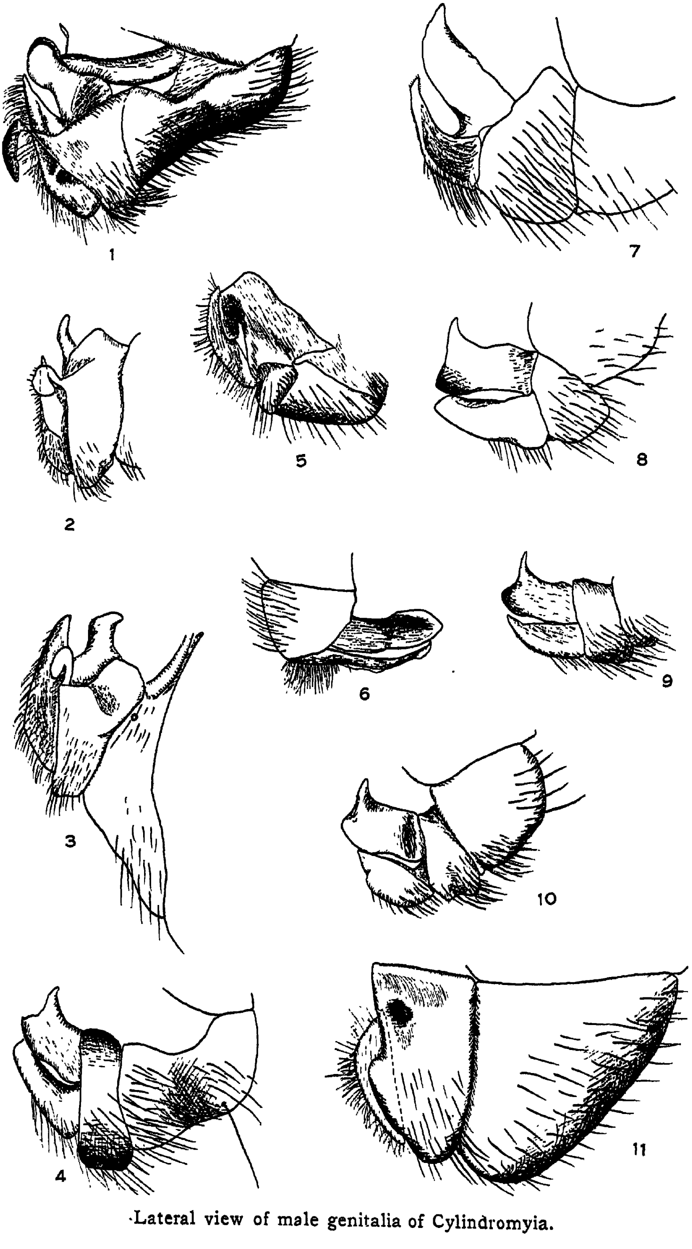

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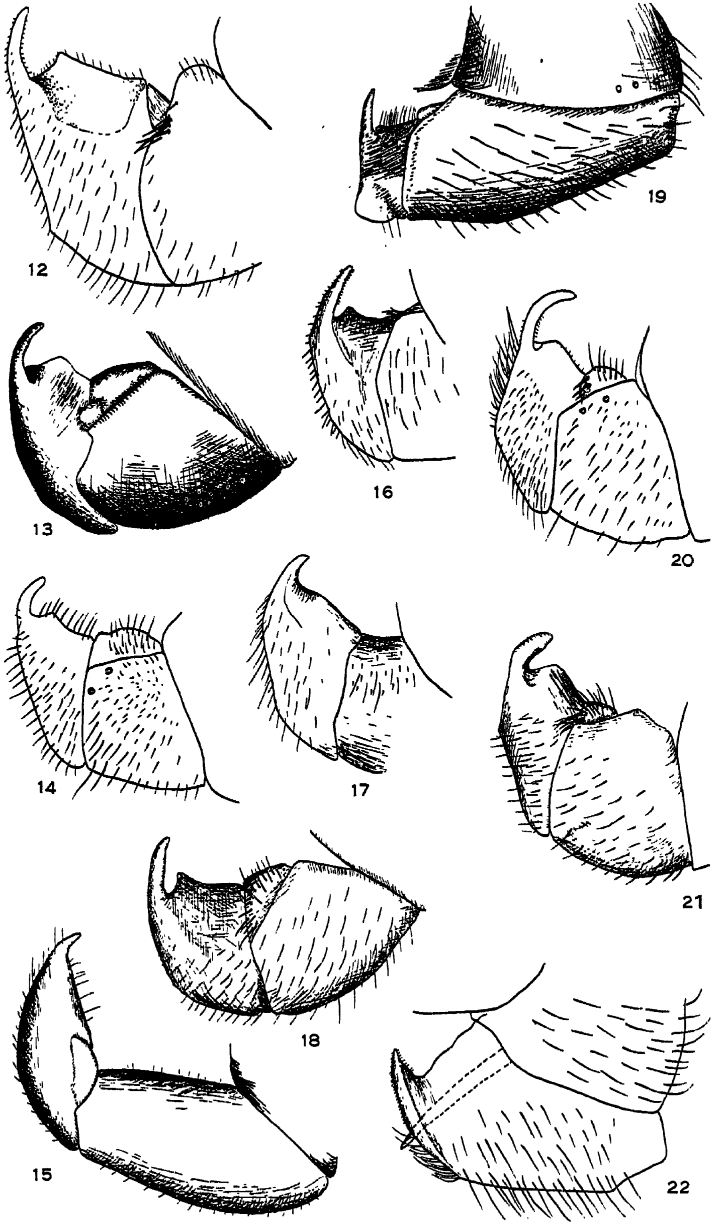

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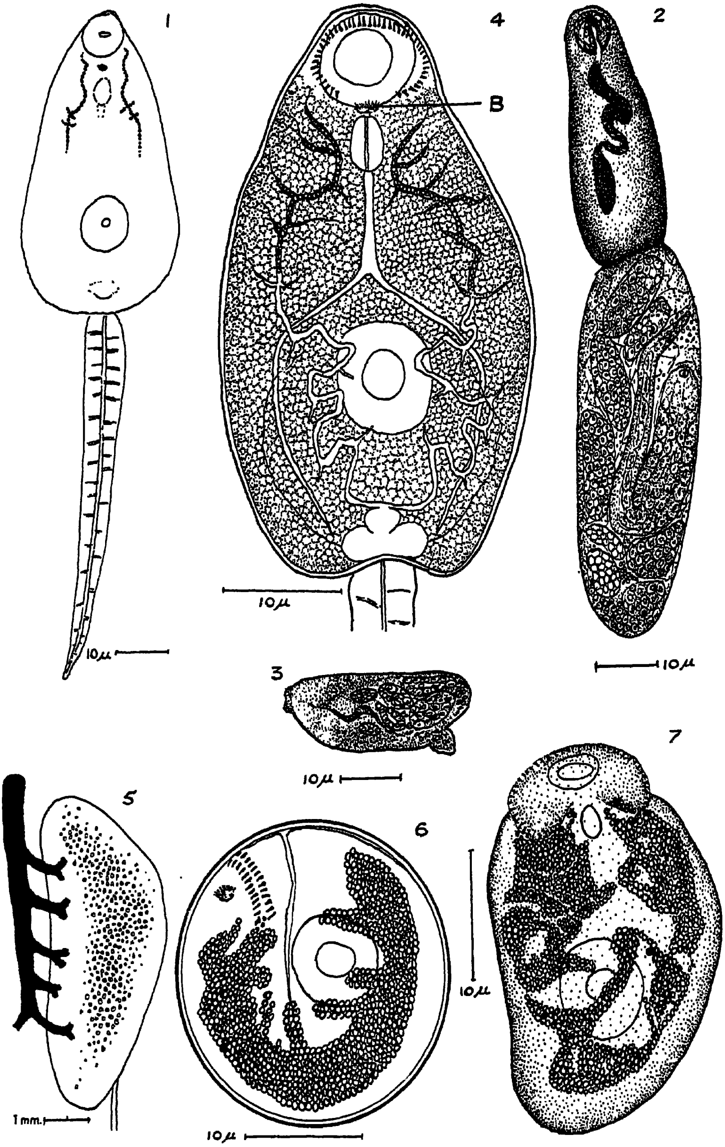

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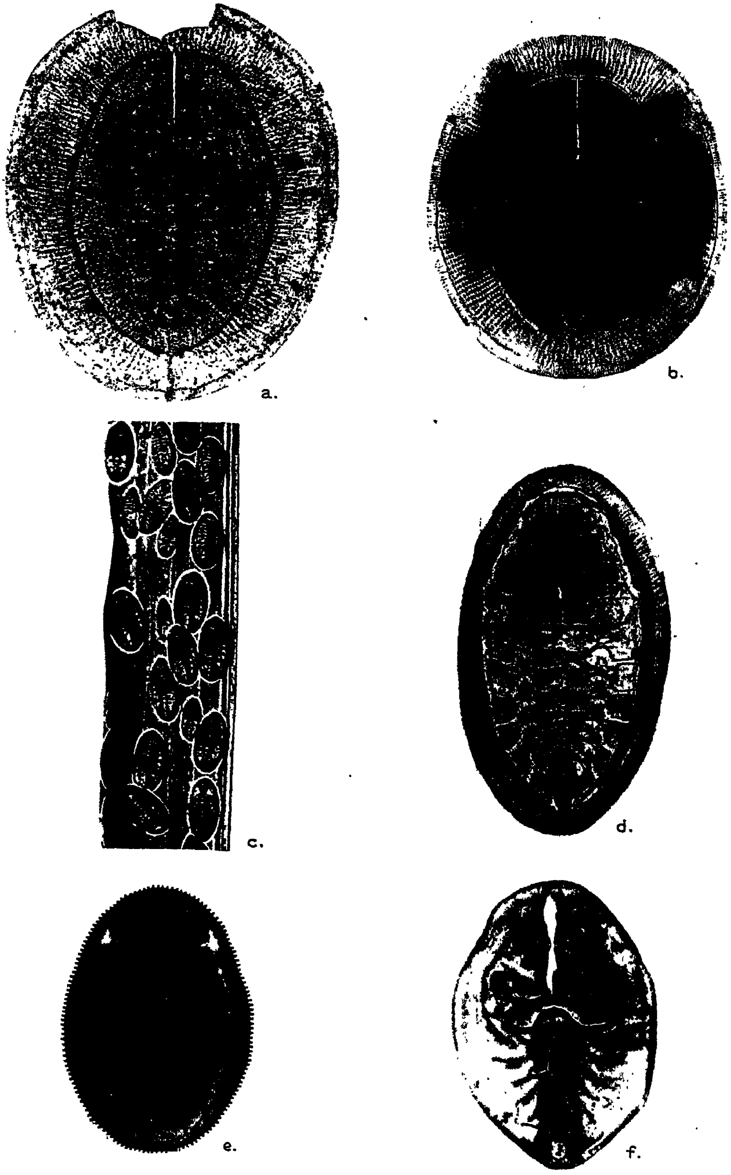

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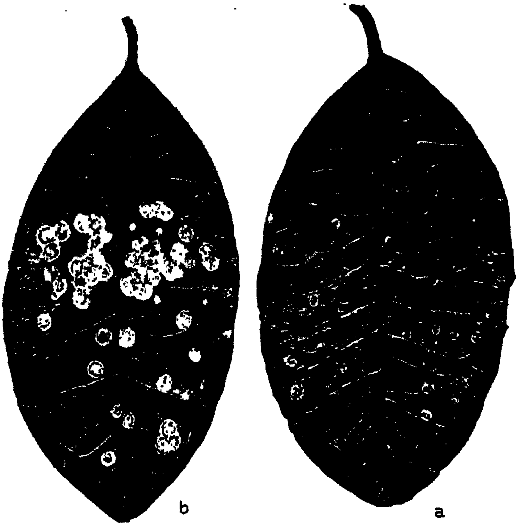

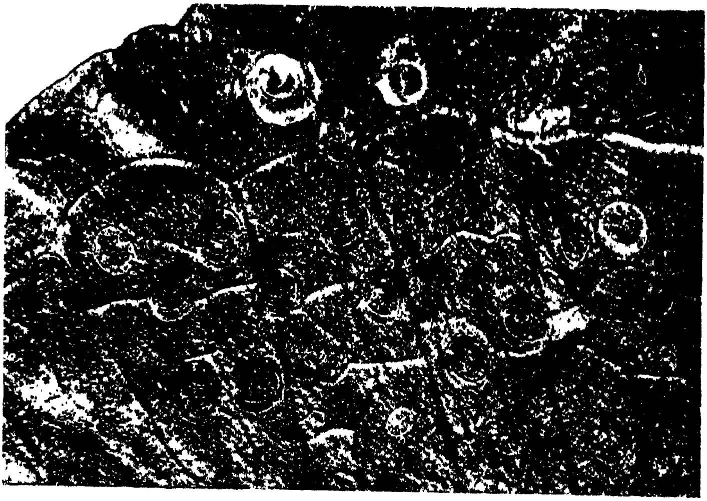

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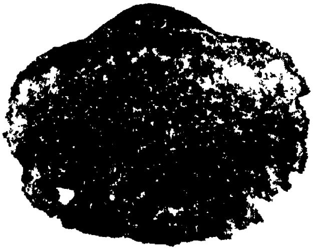

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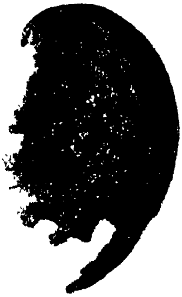

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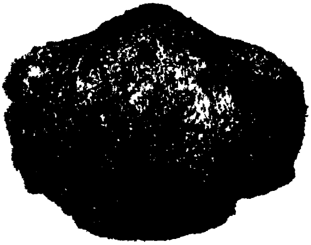

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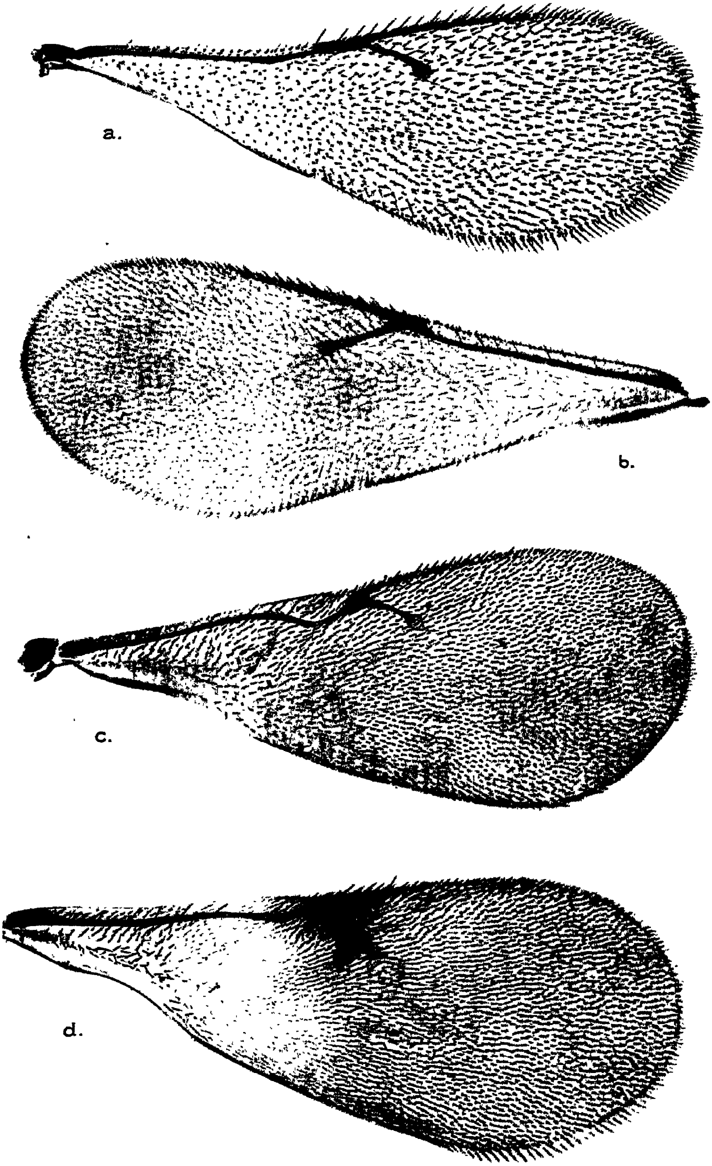

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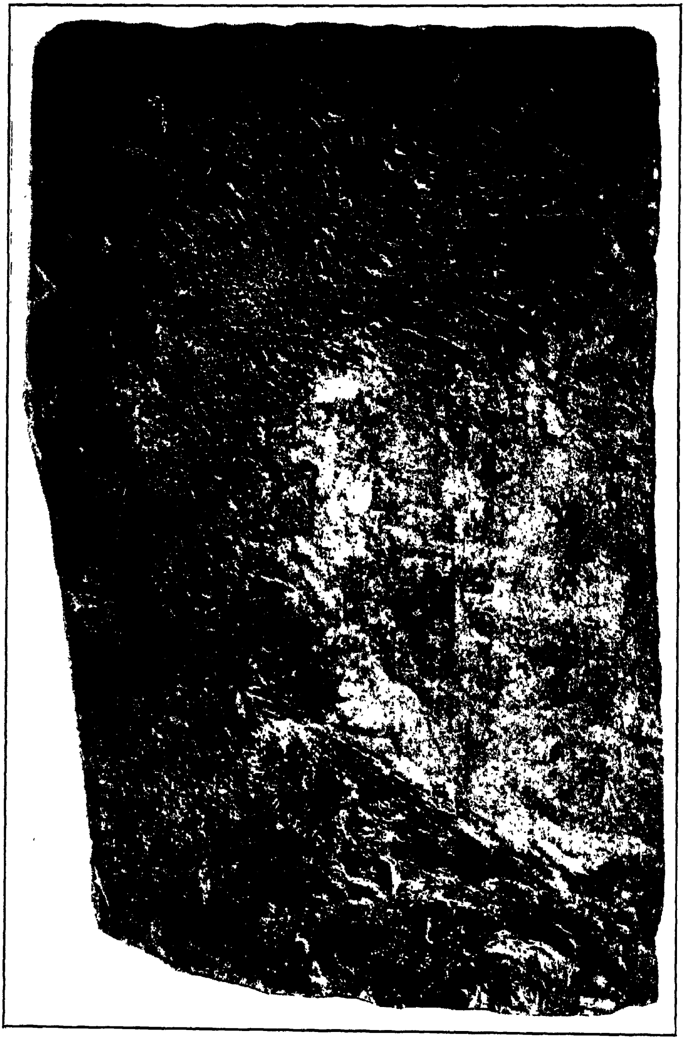

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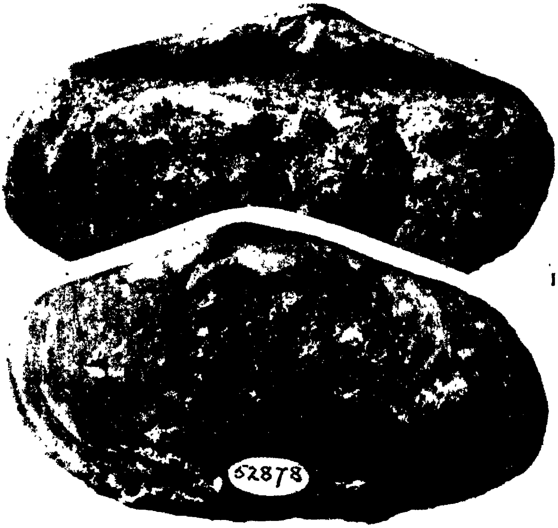

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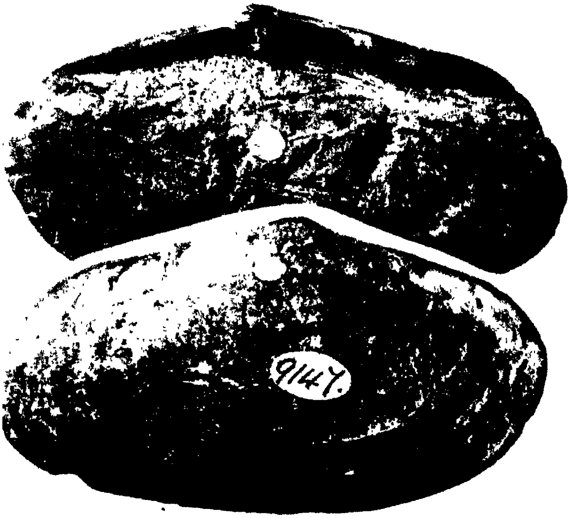

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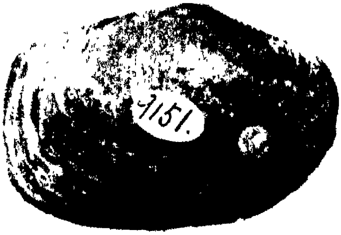

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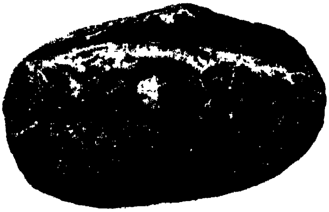

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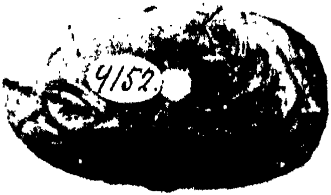

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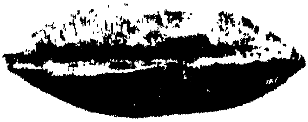

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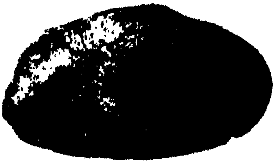

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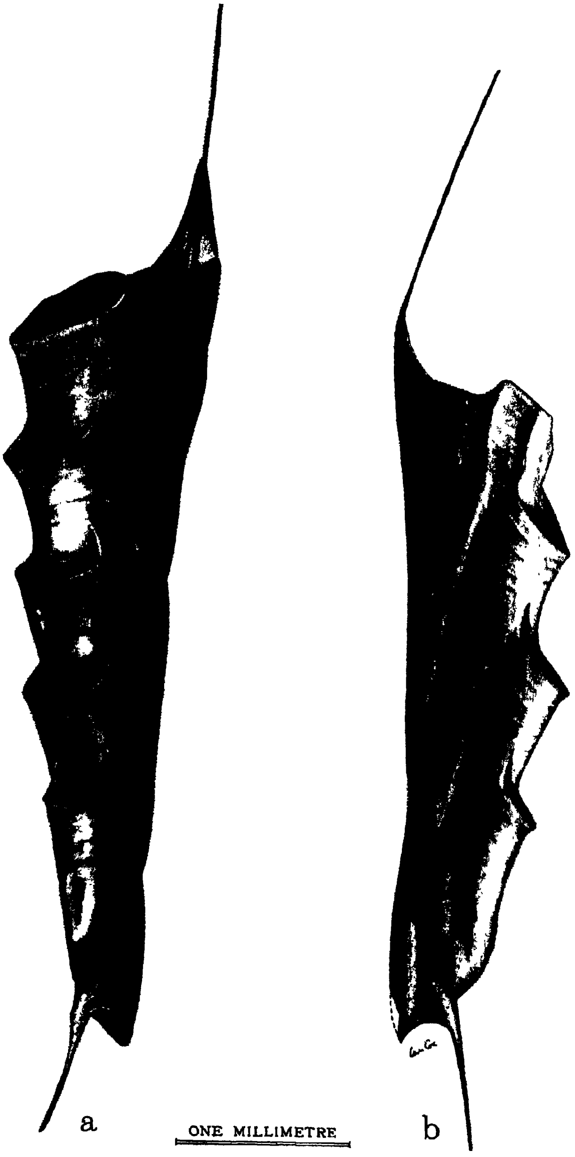

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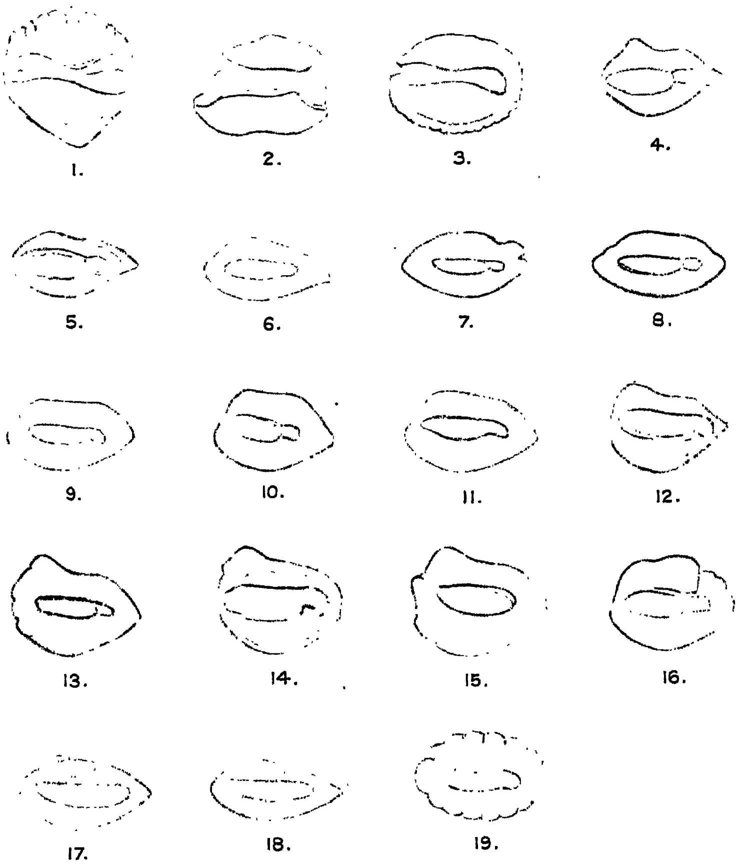

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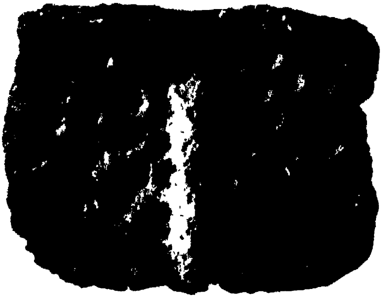

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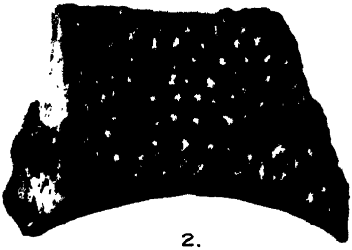

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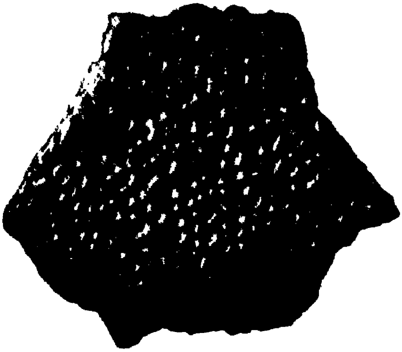

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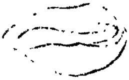

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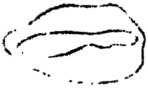

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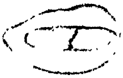

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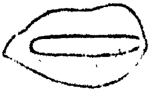

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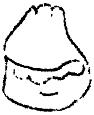

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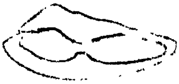

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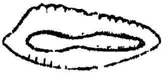

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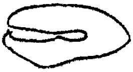

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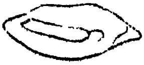

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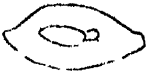

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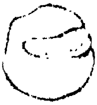

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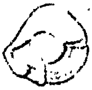

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FOSSIL OTOLITHS OF THE ORDERS ANACANTHINI, HETEROSOMATA, OSTARIOPHYSI.

WHITTARD

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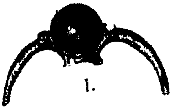

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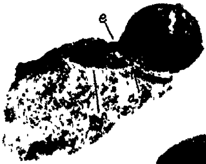

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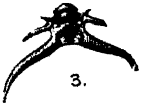

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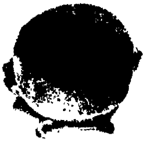

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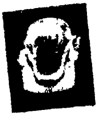

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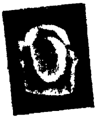

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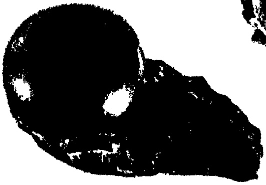

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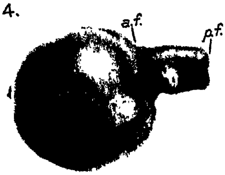

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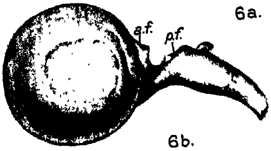

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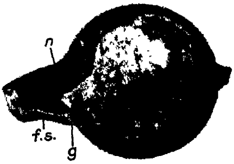

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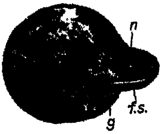

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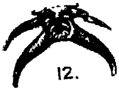

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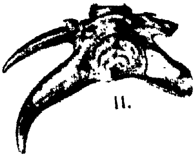

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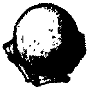

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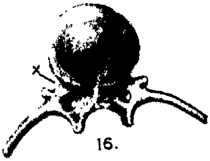

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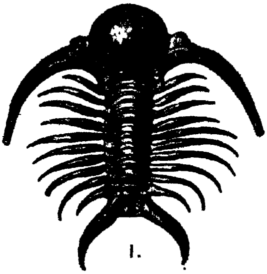

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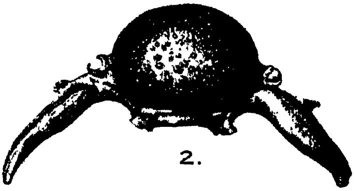

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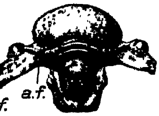

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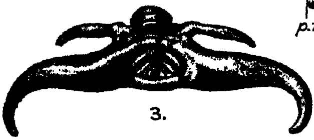

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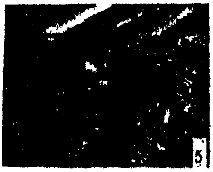

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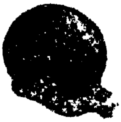

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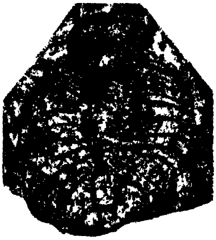

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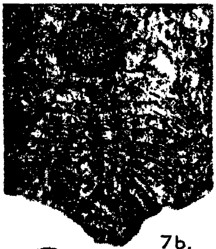

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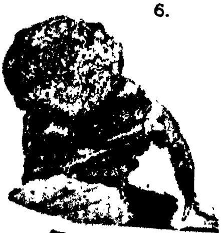

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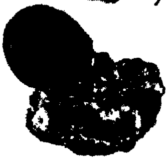

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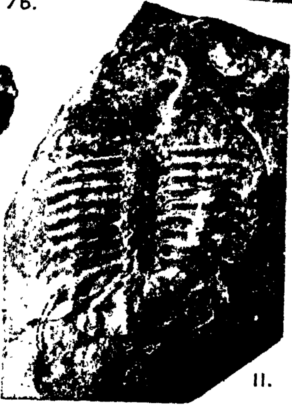

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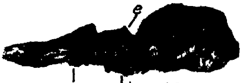

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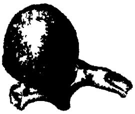

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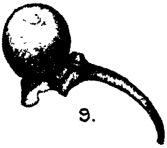

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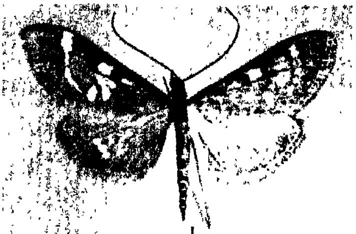

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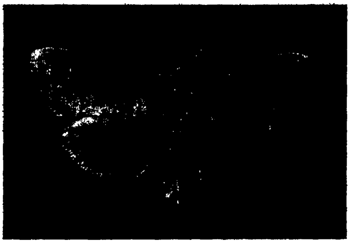

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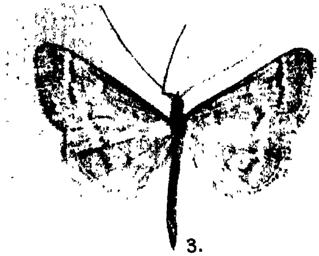

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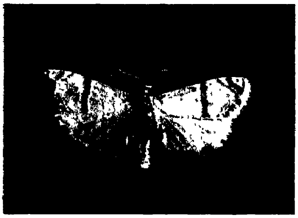

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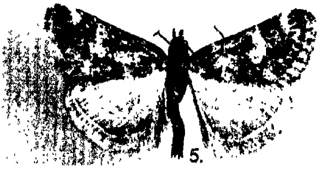

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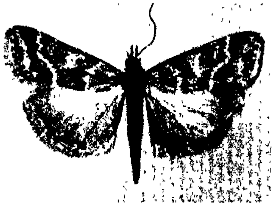

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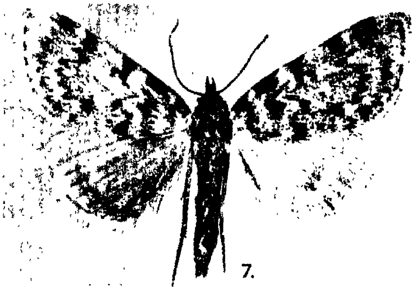

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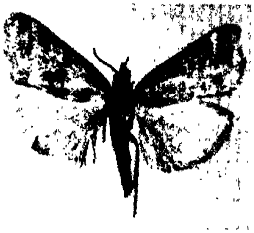

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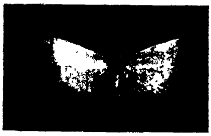

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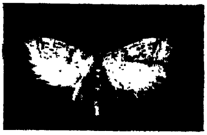

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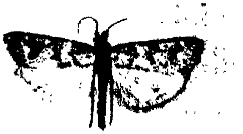

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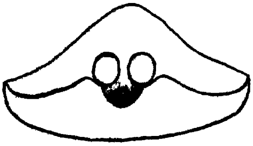

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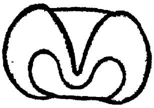

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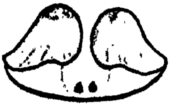

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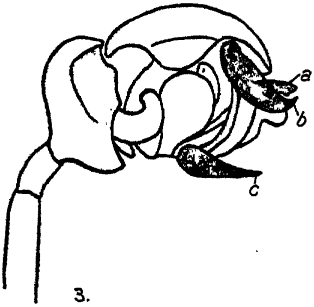

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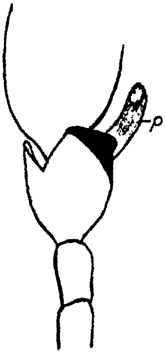

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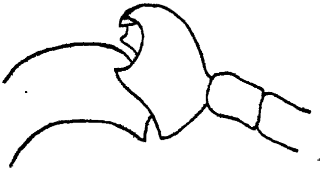

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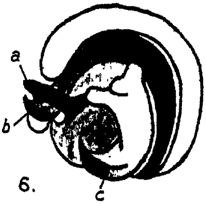

6.

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